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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXV

WITH 26 PLATES

1937

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

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ONE DOLLAR A YEAR SINGLE NUMBER FIFTEEN CENTS

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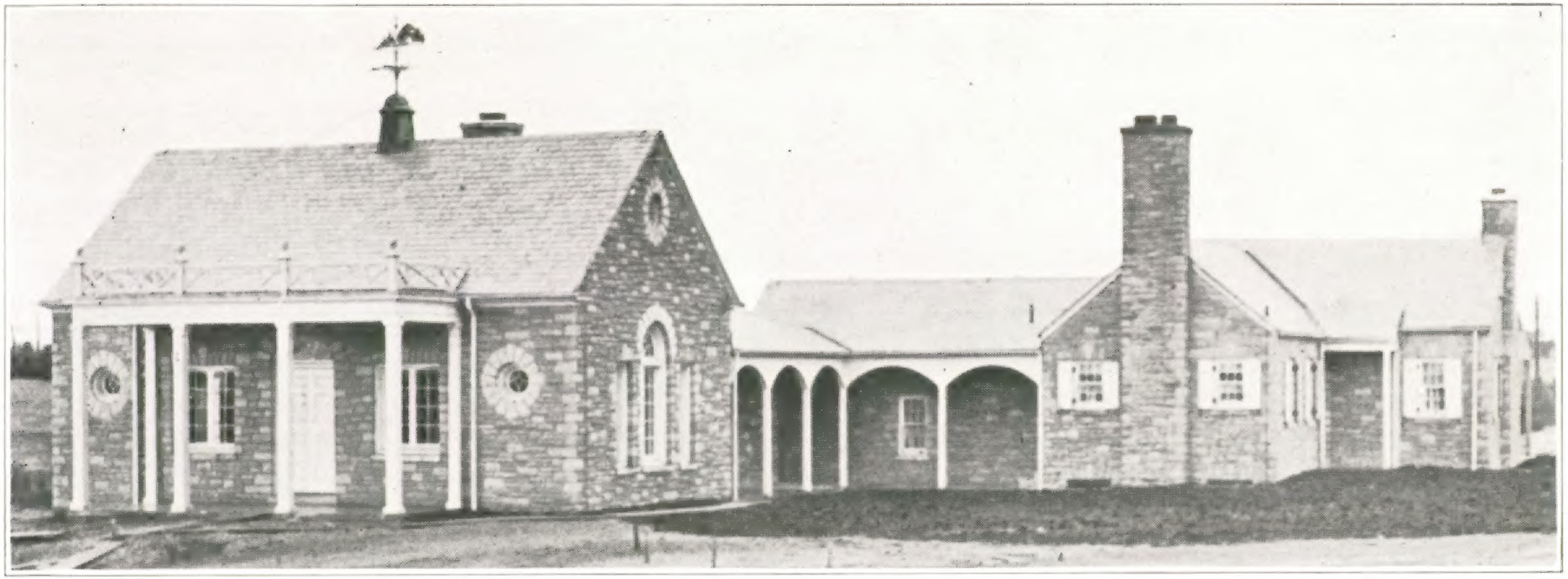

REST ROOMS AND KEEPER'S LODGE AT ARBORETUM—ERECTED 1936

SIDE VIEW OF REST ROOMS AND LODGE

Missouri Botanical Garden Bulletin

Vol. XXV JANUARY, 1937 No. 1

FORTY-EIGHTH ANNUAL REPORT OF THE DIRECTOR

To the Board of Trustees:

The Director has the honor to submit his report for the year 1936.

That the record for prolonged and extreme cold as well as for prolonged and extreme heat and drought should both have been attained in the year just closing is a matter of the greatest consequence to an institution like the Garden. Temperature and moisture are factors of the utmost importance to plants and when these are beyond control the resulting damage is a vital matter to all those responsible for the care of plants.

Details of the effect of the two unprecedented seasons on plants both under glass and out of doors appeared in the Bulletin for May and September respectively and need not be repeated here. These reports emphasize the necessity of doing everything possible to offset the effect of subsequent hot dry spells.

Plans for controlling the temperature of greenhouses containing some of the more valuable plants are being perfected, but experiments carried on several years ago demonstrated that any attempt to lower the temperature on any large scale was neither effective nor feasible. Water is of course available in any quantity. For the trees, shrubs, and herbaceous plants out of doors a system of irrigation far beyond anything previously available had to be devised. In a region with an average rainfall of nearly forty inches this might seem unnecessary, but the following statement of the actual conditions to be met will emphasize the importance of increasing the water supply.

1. From 15 to 20 per cent of the surface of the Garden is occupied by buildings, walks, and roads.

2. The storm-water drainage system removes all surface water not immediately held or absorbed by the soil. This is as it should be.

3. Large trees shelter from rain a considerable portion of the ground. This increases evaporation, reduces percolation, and favors run-off, since most of the rain is concentrated at the tips of the branches before reaching the ground.

4. As trees and shrubs grow larger more and more water is required. Coupled with this fact there has been a shortage of rain for the last six years. Consequently something had to be done to insure the normal growth, if not the life, of the out-of-door vegetation.

In order to reach those areas not served by the city water mains, a centrifugal pump with motor was installed at the edge of the lake in the North American tract. From this point water was pumped to the grove south of the cactus house. At first there was laid a temporary pipe line which carried 3,000 gallons per hour, day and night for two weeks. Then an old main was located and connected, increasing the capacity to 8,000 gallons per hour. It is estimated that 3,210,000 gallons were pumped during the six weeks of operation. The amount of water needed and applied is best shown by that furnished the Mausoleum grove. Pumping began on Monday morning at the rate of 26,400 gallons per eleven-hour day. On Thursday morning a booster pump increased the flow to 44,000 gallons per day. The total amount of water applied was equivalent to an eight-inch rain for this particular area.

The full capacity of the pumping unit could not be developed because of the small temporary pipe lines in use. In December work was started uncovering an old four-inch main 2,155 feet long. It is planned to raise this line to within two feet of the surface and install several outlets to cover the whole area between the main conservatories and the iris garden. This will materially increase the capacity of the system so that sheet irrigation can be carried on at several places simultaneously. It was found during the summer that not more than 4,000 gallons per hour could be discharged from a two-inch pipe line without causing serious erosion.

While the proposed system will deliver many times this amount it will be sent through several outlets, thus avoiding that trouble.

The usual spraying was done in the greenhouses throughout the summer. However, only a dormant spray for scale control was applied outside, this amounting to 3,500 gallons. A rather successful attempt was made to wash the soot from American holly and certain evergreens. The results seem to justify additional efforts in this direction.

Shrub pruning began in March and consisted mainly of severe cutting to rehabilitate plants injured by cold and drought. This work was carried on steadily for seven weeks and continued intermittently all summer. Tree pruning began in April and continued until September. It is safe to say that more brush from pruning was hauled and burned than ever before in a similar period.

The whole nursery, as well as certain other fields from which potting soil is taken, was ploughed and sown to winter vetch. The bent grass around the lily pools was removed, the soil especially prepared, and all of the area re-plugged with a new variety of creeping bent. Forty-eight yards of manure, leaf mold, and peat were hauled for this work. Two of the shrubbery beds in the knolls were shortened and the rest eliminated. After the necessary grading these areas were plugged with bent grass or sown to red-top. In April the bent-grass nurseries were ploughed and plugged. All lawns were raked in March and April and re-seeded. Attempts were made to control weeds in the lawns, nearly 1,000 pounds of iron sulphate and 150 pounds of calcium chlorate being applied either in solution through the sprayer or spread by hand.

The Garden has always furnished feed for the resident quail during the winter, and through the summer most maintenance operations are modified to further their well-being. One serious problem is the mowing of the grass in the open fields. The mowing season comes at a time when the quail are nesting but generally an effort is made to postpone it until incubation is over. Last year quail were found nesting in late August and a few nests were accidentally destroyed.

During the summer two rather serious grass fires occurred. Our own fire-fighting equipment, consisting of the tractor and sprayer, has proved efficient in controlling such fires. To facili-

tate fire fighting, the sprayer tank, holding 300 gallons of water, was kept filled and standing in the open. To localize any fires which might start, all the North American tract was subdivided and separated from the Garden by plowed fire lanes.

The tractor has been used for snow removal, ploughing, road rolling, discing, harrowing, cultivating, mowing, raking, and with the trailer in general hauling. The truck throughout the year has hauled on an average of twelve loads per day. Over 200 yards of material have been hauled and shredded into the compost and soil bins. At the present time wheelbarrows and hand-carts are used only in places inaccessible for the truck or tractor and trailer.

Some changes in beds and walks were made in the medicinal garden. About 45 yards of compost and field soil and 10 loads of manure were hauled into this area. Twenty-eight yards of manure, compost, and field soil were brought into the knolls and a smaller amount used in the English, Linnean, and rose gardens. The aroid house was closed from May 20 to September 10 to permit the removal and rebuilding of the walk above the steam tunnel. The design of the walk was changed to allow the use of reinforced concrete instead of exposed steel supports.

Construction and repairs.—The majority of the greenhouses are twenty-five years old or older and their maintenance calls for increasing care as the years go by. During the summer the entire roof of the citrus house was rebuilt and the gable ends of the citrus and aroid houses were dismantled and many mullions replaced. The supporting braces for side ventilators in the exotic range were replaced with new angle irons. Six new concrete water-lily tanks, replacing the old metal tanks, were built. One of the most important items of repair was rebuilding the walk in the aroid house in front of the alcoves. This walk was formerly suspended over the heating trench by means of metal supports, and because of the large crowds using it, had become unsafe. It was rebuilt on concrete foundations and should last indefinitely. It is interesting to know that the cast-iron gratings originally used here were salvaged from the old palm house built by Henry Shaw. In order to afford greater heat radiation, as well as access to steam mains, concrete retaining walls were torn out and rebuilt in the

cactus, cycad, and coffee houses. Guttering and downspouts were replaced on many of the buildings and innumerable minor repairs of all sorts attended to.

The heating plant requires much attention during the summer months in order that it may be kept at its highest efficiency during the winter. Besides replacing and repairing valves, regulators, diaphragms, etc., the 10-inch steam main with 4-inch return mains in the valve chamber were dismantled and repaired. The heating coils in the experimental houses were rearranged and 250 feet of main supply pipe were installed to furnish steam to coils in the Linnean house. All the thermostat traps, numbering over 300, at the ends of the heating coils were removed and cleaned, and the usual amount of attention was given to the boilers, grates, feed pumps, etc.

With the increasing age of all the structures at the Garden, painting becomes a more important item each year. The interior of the palm house was finished during the summer, including the spraying of the lantern with paint. Other interior painting included the citrus house, the aroid house and alcoves, the water-lily alcove, and at the main entrance the rest rooms and offices. The exteriors of the eight growing houses, the citrus house, and the Cleveland Avenue gatehouse, including the roof of the latter, received two coats of paint. All of the wire and iron fences on Magnolia Avenue, on Alfred Avenue from Shenandoah to Magnolia, and on Tower Grove Avenue from Magnolia to Russell, received one coat of black paint.

Some 10,000 permanent labels were either written or stamped and installed. The same number of temporary wooden labels were used, the preparation of which entailed considerable investigation and labor.

OUTDOOR PLANTING

The Knolls.—The knoll borders, comprising 3,250 lineal feet and varying in width from 3 to 12 feet, were entirely replanted in the spring of 1936. These border plantings contain mostly perennial plants although some annuals are added for color during the summer months. Existing groups of perennials were divided and replanted and new plants were added to the collection. Five hun-

dred chrysanthemum plants, representing 50 hardy and all of the new Korean varieties, made a brilliant showing in the fall. These border plantings became well established during the summer, but it required a program of watering unprecedented since these knolls were created in 1914. Revolving and pipe-line sprinklers were operated night and day from the end of May until the middle of September. With this irrigation system it was possible to water all of the trees, shrubs, and border plantings on the knolls in one week. However, the plants dried out so rapidly during the excessive heat spells that this watering had to be repeated each week. The irises were divided and replanted during the summer and in fall many of the peonies were divided and reset. In November 800 bulbs of *Lycoris squamigera* were planted in groups of 10 and 20.

The Linnean Garden.—Very few changes were made in this garden during the year. A few new dwarf perennial asters, some new varieties of irises, and the latest varieties of hardy chrysanthemums were the only new plants added. The perennial borders which parallel the walk from the Linnean garden to the floral display house were trenched to a depth of 2 to 3 feet to eliminate the underlying hardpan.

Rose Garden.—The work, begun several years ago, of preparing the rose beds by the addition of drainage material, fresh soil, and manure, was continued in the fall.

The severe cold of January and February froze the climbing roses to the ground, but the rose canes have again reached their normal height. The bush roses bloomed freely in the spring and again in the autumn, although the fall rose season was not as good as that of 1934. The beneficial rains and cooler weather came too late for the roses to fully recover before hard frost, and the roses that did open during the hot mid-summer days were scorched. Very few rose plants actually died from the excessive heat. With frequent watering they maintained their strength, but made very little growth until cooler weather returned after the middle of September.

Red spider was the most troublesome insect pest. The roses were free from any mildew or black spot, due to the rigid spraying

and dusting program carried out each year, and also to the extremely dry weather which holds these diseases in check.

Some rose species, polyantha and hybrid perpetual roses, were grown in nursery rows. When only one plant of a variety is available it is better cared for in a nursery row than in a display garden.

Italian Garden.—The California privet hedges were badly frozen and had to be cut to the ground, but by early August they had again grown high enough for shearing. The bedding plants grew well despite the excessive heat.

Economic Garden.—A Mexican Amaranthus termed "Alegria" and an improved variety of Jerusalem artichoke were the only two new plants added to the collection of farm crops grown in the economic garden. The Mexican plant grew exceptionally well and produced much seed. This seed is very tiny, barely as large as a pin head, but is said to compare favorably with the common popcorn in its proportionate increase in volume when popped. However, a photograph of this popped seed must be enlarged ten times before it measures even one-half inch in diameter. The carnival crowds need have no fear that their favorite confection will ever be denied them by substituting for it this popped seed from Mexico.

Iris Garden.—Pleasant weather prevailed in mid-May when the irises and peonies bloomed, and many enthusiastic gardeners visited this display. As has been stated in previous reports, it is regretted that this garden does not contain more of the newer varieties of irises. The only donation was from Dr. Henry J. Gerling, Superintendent of Public Schools, who presented 75 of his choice varieties not represented in the Garden collection. The peonies were beautiful, their best blooming season since the establishment of this collection in 1933.

EXPERIMENTAL HOUSES

Approximately 800 packets of seed received from various botanical gardens were sown, and about 50 per cent germinated. The usual test of the "All America Annuals" was conducted, but

owing to the very unfavorable season it would hardly be fair to list the results. Numerous other annuals were tested with only fair results. The variety tests of geraniums *(Pelargonium hortorum)* were continued. Practically all of the commercial varieties of geraniums in the United States have been raised to determine their respective merits as bedding plants. Several show definite resistance to heat and drought and are being used for hybridization. The collection was supplemented by gifts of cuttings from other growers, an interesting lot having been received from the John Innes Horticultural Institution, of England. Over 1,700 seedling geraniums were raised during the past season, with the object of developing if possible a resistant strain with larger and better flowers. Hybridization experiments are likewise being conducted with Penstemons, a number of select species and varieties having been accumulated.

FLORAL DISPLAYS

The schedule of floral displays was maintained as in the past years. In the early part of the year the orchids were exhibited. These were followed in succession by the azaleas, cinerarias, and various other seasonable spring flowers.

The St. Louis Horticultural Society held its spring show on May 23 and 24. The hydrangea show followed and then the fancy-leaved caladiums occupied the house until the fall.

The Veiled Prophet Queen's bouquet was displayed on October 8, and the St. Louis Horticultural Society held its fall dahlia show on October 10 and 11.

During November the chrysanthemums filled the entire show house. Viewing the show in all its glory in November, it is hard to remember that many of the chrysanthemums on display were growing in the greenhouses during the several months when the thermometer daily climbed to 120 degrees. It was only through the painstaking care of the grower during such an unfavorable season that it was possible to bring the flowers to perfection. Bush chrysanthemums grown outdoors during the summer did not have to endure the terrific heat under glass as did the cascade or the single-stem varieties. Floral displays are viewed by thousands

of visitors, few of whom realize the amount of care required to bring these exhibits into existence.

The poinsettias and various accessory plants were shown during December.

Main conservatories and exotic ranges.—A walk through the main conservatories reveals an astonishing number of tropical plants. More different kinds of palms are to be seen here than on several trips to the tropics; more trees and shrubs of economic importance can be observed in a brief time than on an extended voyage around the world; and the desert collection of grotesque and picturesque plants is so extensive that it has earned the distinction of being the largest and finest under glass in America.

No changes of great importance have been made in the palm, economic, cycad-fern and banana-coffee houses, but the marked growth of some of the trees in the economic house is noteworthy. Due to heavy applications of manure and commercial fertilizers, most of the trees have grown so vigorously as to present a dense tropical verdure overhead. Some of the trees that have especially responded to this treatment are the Manila tamarind, the sandbox, the star-apple, upas, mango, olive-wood, senna, and banyan. The two fine specimens of the banyan tree have spread their branches over a wide area, and numerous thickened aerial roots drop down to the ground from above.

The succulent collection has been increased greatly and now numbers over 1,000 different species, of which about 600 are of American origin, including the cacti, yuccas, agaves, and other desert types, while the remainder belong to the flora of South Africa and other regions of the eastern hemisphere. Among the latter the aloes are the most conspicuous and include about 100 varieties, most of them of flowering size. Over 1,300 seedlings of succulents have been propagated and all are doing exceedingly well.

No marked changes have been made in the content of the exotic range. The building of a new concrete walk in the aroid house necessitated the resetting of the plants. Advantage was taken of the opportunity to add several tons of fresh soil both here and in the citrus house.

ATTENDANCE FOR 1936

(Not including visitors to Arboretum and Tropical Station)

	Week-days	Sundays
January	5,570	5,359
February	3,581	2,388
March	10,767	16,528
April	14,678	22,101
May	24,295	19,549
June	16,987	9,710
July	15,691	6,434
August	19,576	12,994
September	15,565	9,760
October	17,113	19,576
November	20,482	26,803
December	10,580	11,544
	174,885	162,746
		174,885
Total		337,631

THE ARBORETUM

Perhaps the most notable improvement at the Arboretum is the completion of the building containing the rest rooms and lodge at what will eventually be the main entrance. Unfortunately, it does not follow that the Arboretum will now be open to the public since the system of roads is far from complete and there is no assurance when these will be built.

The nurseries continue to be the most important adjunct in the operations at the Arboretum. Three thousand miscellaneous small trees and shrubs have been transplanted in nursery rows from seed-beds, and an even greater number transplanted into the nursery. Four hundred linear feet of 4-foot seed-frames were sowed. Over 2,000 trees and shrubs were removed from the nurseries and planted in permanent positions at various places on the grounds. The orchards of apples, flowering cherry, and flowering crabs have been regularly pruned, sprayed, and cultivated, and the usual amount of grass, hay, and weeds cut and attended to. Much extra time during the summer months had to be devoted to watering as well as to fire prevention and control. Several miles of 20-foot fire lanes were ploughed. A small fire started in the woods on July 30, but fortunately little damage was done before

it was brought under control. Some 430 truck loads of gravel were hauled from our own gravel bar to be used on the roads, and much general repair work was attended to where needed.

The greenhouses at the Arboretum, which are devoted almost exclusively to the orchid collection, were maintained much as usual, with some minor changes as to steam-pipes, drains, etc. Some 23,000 orchid plants were repotted, and nearly 15,000 orchid flowers of all sorts were cut or displayed.

HOURS OF SUNSHINE RECORDED IN 1936

About 185 hours of sunshine were available at the Arboretum over and above that recorded at the St. Louis Garden. This was 100 hours more than that reported for 1935. As has been repeatedly pointed out, it is not so much the greater amount of sunshine during the entire year that makes more favorable the growing of plants at the Arboretum but the fact that this excess comes during the late fall and winter months. Never less than 100 hours of extra sun, and in some years nearly 150 hours, has a manifest effect on plants.

Month	City Garden	Arboretum
January	95	109¾
February	104	141
March	194	213
April	210½	217¾
May	306	306
June	308½	322¾
July	334	355
August	295	298
September	172	182
October	185	199½
November	173	208
December	120½	131
	2,497½	2,683¾
		2,497½
Excess at Arboretum		186¼

TROPICAL STATION, BALBOA, C. Z.

Since the death of Mr. A. A. Hunter in 1935, Mrs. Hunter has been in charge of the Station and has carried on the routine activities most admirably. However, this arrangement was regarded

as only temporary, since she desired to return to the States. Consequently, in October, Mr. Paul H. Allen was appointed resident manager and has been in charge for the past few months. Mr. Allen completed his apprenticeship at the Garden in 1935. He then had the advantage of spending six months at the Station during which time he made frequent collecting trips with Mr. Hunter and others. He returned to the Garden in the summer of 1936, where he especially prepared himself for duties in the tropics. Since arriving at the Station, Mr. Allen has undertaken the rearrangement of the orchids according to their respective genera and has been able to make several collecting trips with the idea of replenishing and augmenting the collection of Panamanian orchids.

ANNUAL BEQUESTS

The annual flower sermon "On the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for in the will of Henry Shaw, was preached at Christ Church Cathedral on April 26, by the Rt. Rev. Robert E. L. Strider, Bishop Coadjutor of West Virginia.

The Trustees' Banquet Fund, inaugurated under the will of Henry Shaw, was not used during 1936.

The Gardeners' Banquet Fund was drawn upon at Christmas time for the provision of turkeys for employees of the Garden.

The fund for the provision of prizes at flower shows was not used during 1936.

RESEARCH AND INSTRUCTION

Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, has devoted a greater part of the time to curatorial duties. In addition, however, he has directed the research work of graduate students in taxonomy and has given advanced courses in comparative morphology and taxonomy of the higher plants, and in plant geography. The present enrollment in the advanced course, scheduled in the Washington University Catalogue of the School of Graduate Studies as "Botany 50. Morphology and Taxonomy

of Bryophytes and Pteridophytes," is the largest in this course since it was organized nearly twenty years ago. Dr. Greenman has also continued to carry on taxonomic research in special problems which have been under way for several years. The special problems concern particularly monographic studies in the genus *Senecio,* a detailed study of plants of Central America collected by J. M. and M. T. Greenman in 1920 and 1921, and preparations for a Flora of the Southwest.

Dr. C. W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, in company with Mrs. Dodge and Mr. Verne F. Goerger as assistant through a grant from the Science Research Fund of Washington University, spent from June to September in Costa Rica in continuation of his studies on Costa Rican lichens and Agaricaceae. Four areas were selected for intensive study: Guayabillos, on the upper slopes of the volcano Irazú at 2,000–2,350 m., through the courtesy of Ing. Bernardo Yglesias; R. Castilla on the flood plain of the R. Reventazon at about 30 m., through the courtesy of Ing. F. Nevermann, the coleopterist; the flood-plain of R. Paquita halfway between Puntarenas and Golfo Dulce, a region not previously visited by botanists, through the courtesy of Ing. Ricardo; Chavarría R. and R. Sándalo on the peninsula of Osa along the shores of Golfo Dulce, through the courtesy of Mr. H. J. Marks. Short trips were taken to various localities on the Meseta Central. About 2,500 specimens representing 1,700 species were secured for further study. Work was greatly facilitated by the many courtesies of Sr. don Juvenal Valerio Rodriguez, Director of the Museo Nacional. Some preliminary work was started on a banana disease which greatly reduces the yield although not so seriously as the Panama disease. Dr. C. Picado kindly placed the facilities of the bacteriological laboratory of the Hospital S. Juan de Dios at Dr. Dodge's disposal for this work. Conferences were held with the Secretary of Public Health and the staff of the above hospital on fungous disease of man, and a formal lecture, "Algunas aspectos clínicos de las enfermedades producidas por hongos" was delivered before the Facultad de Medicina and published in a local medical journal.

A week was spent at the Tropical Station in Balboa, C. Z., re-

visiting some localities for additional material. The new University of Panamá was visited through the courtesy of the Secretary of Public Instruction and the rector of the University, and a confidential report on the staff and curriculum was submitted to the U. S. Commissioner of Education. In Cuba, the experiment station of Las Vegas was visited and arrangements made for the exchange of materials and the loan of important collections.

With Dr. S. M. Zeller, the joint monograph on the Hymenogastraceae *(sensu latiore)* has been completed after nearly twenty years of sporadic effort, and published in the ANNALS. The lichens of the G. Allan Hancock Expedition to the Galapagos Archipelago have been published in the papers of that expedition. Work has continued on the lichens of the Second Byrd Antarctic Expedition to Antarctica but publication has been postponed until next year. Large series of lichens have been identified from Haiti and Santo Domingo, collected by W. Stephen Thomas, from Spanish Honduras by T. G. Yuncker, from Panama by G. W. Martin, from eastern Polynesia by H. St. John and F. R. Fosberg, from British North Borneo by the late Rev. Joseph Clemens and Mrs. M. S. Clemens, and from Quebec by Father Ernest Lepage. Mr. U. L. Dubois has facilitated this work by preparation of microscopic slides. Mr. D. F. Flint has aided in clerical work and in the insertion of specimens in the lichen and fungous herbaria.

Dr. Gladys E. Baker, research assistant under a grant from the Science Research Fund of Washington University, secured a permanent position at Hunter College in New York City and resigned October 1. Miss Helen Bramsch, M.S., has accepted the position as research assistant under a grant from the International Cancer Research Foundation. Research is in progress on the effects of carcinogenic compounds on the morphology and cytology of yeasts. In cooperation with Mr. G. T. Johnson, the identification of fungi pathogenic to man has been undertaken for Dr. W. H. Gardner of Miami, Florida.

The usual courses of instruction have been given and research of students supervised. Mr. David Goldring completed his work on the effect of environment on variation and reproduction in *Blakeslea trispora* Thaxter. Mr. Ralph Hervey has continued work on *Thiobacillus*.

Dr. Edgar Anderson, Geneticist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, has continued to center his research work about the species problem. Work on the American species of Iris, begun in 1924, was brought to a final conclusion and published in the September number of the ANNALS. No further work is planned with this genus, though Dr. H. P. Riley of New Orleans is continuing the investigation of certain phases of the problem. For technical reasons the genus *Tradescantia* seems particularly favorable material for further study at this time. The taxonomic monograph published last year by Dr. Anderson and Dr. R. E. Woodson, Jr. and the cytological survey of the American species undertaken by Dr. Karl Sax and Dr. Anderson and brought to a final conclusion this year have given a background of fundamental information in regard to species and their relationships. These basic studies make possible the determination, even the demonstration, of phenomena which would be difficult to study in other genera. Since hybridization between species seems to be of particular significance in this genus, a comprehensive survey of its effects has been undertaken. Experimental and observational work was carried on in the St. Louis area during May and June. A series of popular lectures in the South and Southwest made it possible to finance a three-week trip to Louisiana, Texas, and Oklahoma during April. A preliminary publication on hybridization in *Tradescantia* was made in the September ANNALS and further work is either completed or under way.

These studies on the species problem having been exclusively concerned with intensive investigations of a few species in a few genera, an attempt to balance previous work by making an extensive survey of the species problem in the flora of a limited area was undertaken. The wild-flower reservation at the Arboretum was ideal for such a purpose and work was begun in late June continuing well into the fall. The area chosen for intensive study includes oak-hickory woods, glades, river meadows, flood-plain woods, and gravel bars. It is estimated that about 800 species of flowering plants may be found there. It is planned to identify all the species and varieties critically and to study in each genus the evidence for species-forming forces which are actually at work in

the area. This will include such phenomena as hybridization between species, formation of incipient ecological varieties, random differences between isolated populations, etc. A good beginning has been made at this project and its feasability demonstrated. The herbarium now includes over 200 species, most of which have been critically determined, some of them having been sent to authorities for verification. Hybridization under natural conditions is being studied in *Elymus, Lindernia,* and *Aster.* Surveys of variation have been made in *Rosa setigera* and *Tecoma radicans.*

Correlated with the scientific study of the plants in the wild-flower area has been a detailed examination of the area itself. This knowledge will prove useful in the eventual development of the wild-flower reservation. The different types of vegetation, oak-hickory forest, maple-white oak forest, limestone glades, etc., are being mapped in a detailed way. A beginning has been made of a geological map which will show the formations in the area and their distribution. Detailed knowledge of the present plant cover and its probable dynamics will make it practicable to develop a wild-flower reservation with a minimum of human effort, by the efficient utilization of natural forces.

This year, as last, Dr. Anderson has had full charge of the weekly seminar for graduate students in the Henry Shaw School of Botany. In October a course in plant cytology for graduates and advanced undergraduates was offered for the first time.

Dr. E. S. Reynolds, Physiologist to the Garden and Associate Professor in the Henry Shaw School of Botany of Washington University, has continued two general lines of investigation: (1) various attendant conditions under which changes in growth rate occur in green plants when ultra-violet radiations are used to supplement the ordinary greenhouse illumination; (2) growth rates of fungi with various "growth stimulators" added to standard culture media. An inexpensive and convenient all-glass electrodialysis apparatus to be used with various types of dialyzing membranes has been built. This may be used for general class work and for investigations on the separation of dialyzable and non-dialyzable constituents of plant extracts in analytical and fungous-nutritional studies which are under way. In conjunction with graduate students in physiology new methods of culturing green

plants in the greenhouse and laboratory are being studied. A constant-temperature bath and accessory apparatus for such studies, where controlled alternating periods of light and darkness are needed, has been developed. The University duties of teaching elementary and advanced courses in physiology, including a new course on the physiological aspects of ecology, together with guiding the investigations of graduate students and the general supervision of the departmental work on the campus, have continued as usual.

Dr. Robert E. Woodson, Jr., Research Assistant to the Garden and Assistant Professor in the Henry Shaw School of Botany of Washington University, has continued his research in the taxonomy of the family Apocynaceae. During the early part of the current year research upon the American genera of the subfamily Echitoideae has been brought to a close, completing a monographic project of several years' duration. Projects in taxonomy now under way are principally accounts of the Apocynaceae for the series on the Yucatan flora published by the Carnegie Institution of Washington in conjunction with the University of Michigan, and for the *North American Flora* published serially by the New York Botanical Garden. Morphological and anatomical problems concerning Apocynaceae and Gentianaceae have also been under investigation, aided by a grant during the first half of the current year from the Science Research Fund of Washington University, provided by the Rockefeller Foundation. Preparations have also been made for the publication of novelties and new records of flowering plants indigenous to the Republic of Panama, based upon the results of expeditions from the Missouri Botanical Garden Tropical Station at Balboa, C. Z., to constitute the first of a series entitled "Contributions toward a Flora of Panama." The first records so published will consist principally of materials studied by various specialists of the United States and Europe, from the collections of Russell J. Seibert during 1935.

Much of Dr. Woodson's time has been spent in the teaching of classes in botany offered by the Henry Shaw School of Botany of Washington University. Such classes include those listed as General Plant Biology, Elementary Plant Morphology, and Anatomy of Vascular Plants. The class in General Plant Biology has been

made far more effective during the last half of the current year through the appointment of Miss M. Maxine Larisey as Instructor in Botany.

Research in morphology has been undertaken under Dr. Woodson's direction by Miss Helen M. Bramsch and H. N. Andrews, Jr.

Graduates and Fellows.—The following appointments were made in the Henry Shaw School of Botany for the year 1936-37.

Assistants in Botany: (research assistant) Helen Marie Bramsch, A.B. and M.S., Washington University; (half-time assistants): Henry N. Andrews, Jr., B.S., Massachusetts Institute of Technology (Morphology and Taxonomy); Russell J. Seibert, A.B., Washington University (Taxonomy and Morphology).

Washington University Fellowship: Fred A. Barkley, A.B. and M.S., University of Oklahoma (Taxonomy and Physiology) (also assistant in University College); George Thomas Johnson, B.A., University of Arkansas (Mycology and Taxonomy); Francis Marion Ownbey, Jr., B.A. and M.A., University of Wyoming (Taxonomy).

Jessie R. Barr Fellowship, Washington University: Ruth E. Peck, A.B., Grinnell College (Cytology and Taxonomy).

Washington University Van Blarcom Scholarship: Stanley H. Hagen, B.S., University of Oklahoma (Taxonomy and Physiology).

Special Research Fellowship, American Creosoting Company: Hereford Garland, B.S. and M.S., University of California (Physiology, Taxonomy and Anatomy).

Independent Students: Edward Cain Berry, B.S., Central Missouri State Teachers College, A.M., University of Missouri (Mycology); Hugh Carson Cutler, B.A. and M.A., University of Wisconsin (Taxonomy); Gordon William Davis, A.B., Knox College (Physiology); Howard William Larsh, A.B., McKendree College (Pathology); Charlotte Josephine Manewal, B.A., Harris Teachers College (Physiology and Education).

Degrees.—The following students in the Henry Shaw School of Botany received advanced degrees at the Washington University commencement in June: Louis Otho Williams, Doctor of Philosophy (Taxonomy and Anatomy); Helen Marie Bramsch, Master of Science (Anatomy and Zoology).

Apprenticeships.—Apprentices now enrolled under the three-year arrangement are Karl E. Busch, Francis C. Harris, and Arthur B. Hoffman. No new appointments were made in 1936.

As in previous years, the lecture and demonstration course in gardening for amateurs and another course of a more advanced character were given during 1936.

Published Articles.—

Anderson, Edgar. An American Pedigree for Woolly Hair. Jour. Hered. **27:** 444. 1936.

Anderson, Edgar. Are Flower Shows Really Helpful? House Beautiful **78:** 79. 1936.

Anderson, Edgar (with Turrill, W. B.). Biometric Studies on Herbarium Material. Nature **136:** 986. 1935.

Anderson, Edgar. Color Variation in Eastern North American Flowers as Exemplified by *Hepatica acutiloba.* Rhodora **38:** 301–304. 1936.

Anderson, Edgar (with Sax, Karl). A Cytological Monograph of the American Species of Tradescantia. Bot. Gaz. **97:** 433–476. 1936.

Anderson, Edgar. Damage to Forest Trees at the Arboretum. Mo. Bot. Gard. Bull. **24:** 163–169. 1936.

Anderson, Edgar. An Experimental Study of Hybridization in the Genus Apocynum. Ann. Mo. Bot. Gard. **23:** 159–168. 1936.

Anderson, Edgar (with Pring, G. H.). Ground Covers for St. Louis Gardens. Mo. Bot. Gard. Bull. **24:** 186–193. 1936.

Anderson, Edgar. Hybridization in American Tradescantias. Ann. Mo. Bot. Gard. **23:** 511–525. 1936.

Anderson, Edgar. A Morphological Comparison of Triploid and Tetraploid Interspecific Hybrids in Tradescantia. Genetics **21:** 61–65. 1936.

Anderson, Edgar. Oriental Crab-apples. Bull. Arnold Arboretum. December, 1935. Reprinted Garden Digest **8:** 18–20. 1936.

Anderson, Edgar. The Species Problem in Iris. Ann. Mo. Bot. Gard. **23:** 457–509. 1936.

Anderson, Edgar. The Tarragons, Cultivated and Wild. Herbarist **1936:** 9–11. 1936.

Anderson, Edgar. *Viburnum fragrans.* Gard. Chron. [British]. ser. 3. **99:** 197. 1936.

Andrews, H. N., Jr. A New Sequoioxylon from Florissant, Colorado. Ann. Mo. Bot. Gard. **23:** 439–446. 1936.

Andrews, H. N., Jr. (with Moore, John Adam). Transitional Pitting in Tracheids of Psilotum. Ann. Mo. Bot. Gard. **23:** 151–158. 1936.

Baker, Gladys E. A Study of the Genus Helicogloea. Ann. Mo. Bot. Gard. **23:** 69–128. 1936.

Barkley, F. A. The Effects of Environmental Conditions in Producing Leaf Variation in Poison Ivy. Biologist **17:** 122–123. 1936.

Barkley, F. A. Five-leaved Poison Ivy. Biologist **17:** 122. 1936.

Barkley, F. A. (with Sweet, Herman R.). A Most Useful Plant Family, the Anacardiaceae. Mo. Bot. Gard. Bull. **24:** 216–229. 1936.

Barkley, F. A. A Note on the Shrubs of a Desert Plains Community in Nolan County, Texas. Ecology **17:** 178–184. 1936.

Beilmann, A. P. Another Drought Warning. Mo. Bot. Gard. Bull. **24:** 229–231. 1936.

Beilmann, A. P. Feeding the Shade Trees. Mo. Bot. Gard. Bull. **24:** 95–113. 1936.

Beilmann, A. P. Some Migratory Trees. Mo. Bot. Gard. Bull. **24:** 119–123. 1936.

Beilmann, A. P. Some Notes on a "Brooding" Scale Insect. Mo. Bot. Gard. Bull. **24:** 126–130. 1936.

Beilmann, A. P. Temperature and Moisture Determinations in Trees. Mo. Bot. Gard. Bull. **24:** 169–173. 1936.

Cutak, Ladislaus. Free-Blooming Cacti for the Amateur. Mo. Bot. Gard. Bull. **24:** 194–197. 1936.

Cutak, Ladislaus. The Missouri Botanical Garden. Cactus and Succulent Jour. **8:** 54–56. 1936.

Cutak, Ladislaus. Plant Life in the Grand Canyon Region. Mo. Bot. Gard. Bull. **24:** 205–208. 1936.

Cutak, Ladislaus. That Elusive *Neomammillaria Wrightii.* Mo. Bot. Gard. Bull. **24:** 201–204. 1936.

Cutak, Ladislaus. Washingtonia—A Desert Palm. Mo. Bot. Gard. Bull. **24:** 123–126. 1936.

Dodge, C. W. (with Zeller, S. M.). Hydnangium and Related Genera. Ann. Mo. Bot. Gard. **23:** 565–598; Elasmomyces, Arcangeliella, and Macowanites. *Ibid.* 599–638; Melanogaster. *Ibid.* 639–656. 1936.

Dodge, C. W. (with Moore, Morris). Morphology, Physiology and Cytology of *Syringospora inexorabilis (Monilia inexorabilis).* Ann. Mo. Bot. Gard. **23:** 129–150. 1936.

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Jensen, L. P. Damage to Plantations in the Arboretum. Mo. Bot. Gard. Bull. **24:** 172–173. 1936.

Kohl, Paul A. *Lycoris squamigera.* Mo. Bot. Gard. Bull. **24:** 185–186. 1936.

Moore, John A. (with Andrews, H. N., Jr.). Transitional Pitting in Tracheids of Psilotum. Ann. Mo. Bot. Gard. **23:** 151–158. 1936.

Pinkerton, M. Elizabeth. A Comparative Study of Conidial Formation in Cephalosporium and Some Related Hyphomycetes. Ann. Mo. Bot. Gard. **23:** 1–68. 1936.

Pring, G. H. The Cultivation of Orchids. New Dictionary of Gardening. 1936.

Pring, G. H. The Effect of High Temperature on Orchids under Glass. Mo. Bot. Gard. Bull. **24:** 173–179. 1936.

Pring, G. H. (with Anderson, Edgar). Ground Covers for St. Louis Gardens. Mo. Bot. Gard. Bull. **24:** 186–193. 1936.

Pring, G. H. Success with Water-lilies. Boston Herald. March 22, 1936.

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Pring, G. H. Water Gardens. N. Y. Herald-Tribune. March 15, 1936.

Pring, G. H. Water-lilies. Gard. Chron. of America **40:** 48–49. 1936.

Williams, L. O. Field and Herbarium Studies, IV. Ann. Mo. Bot. Gard. **23:** 447–456. 1936.

Woodson, Robert E., Jr. Additions to the Genus Amsonia. Bull. Torrey Bot. Club **63:** 35–37. 1936.

Woodson, Robert E., Jr. Studies in the Apocynaceae. IV. The American Genera of Echitoideae (Concluded). Ann. Mo. Bot. Gard. **23:** 169–438. 1936.

Woodson, Robert E., Jr. Studies in the Apocynaceae. V.—A Revision of the Asiatic Species of Trachelospermum Lem. Sunyatensia **3:** 65–105. 1936.

Woodson, Robert E., Jr. Observations on the Floral Fibres of Certain Gentianaceae. Ann. Bot. **50:** 759–766. 1936.

Scientific and Popular Lectures.—

Dr. Edgar Anderson, Geneticist to the Garden: January 9, Women's Council of the Union Avenue Christian Church, "Science from the Inside"; February 19, St. Louis Unit of the Women's Overseas Service League, "Plant Hunting in the Balkans"; April 16, New Orleans Academy of Science, "Botanical Gardens"; April 23, joint meeting of Sem Bot and Sigma Xi, University of Oklahoma, "Plant Collecting in the Balkans"; April 24, Oklahoma College for Women, Chickasha, "Plant Hunting in the Balkans"; April 28, College of the Ozarks, Clarksville, Arkansas, "Science and Nationalism in the Balkans"; June 13, entomology section of the St. Louis Academy of Science, "Mendelian Characters and Their Inheritance"; September 5, Genetics Society, Woods Hole, Mass., "Hybridization in Natural Populations of Tradescantia"; October 22, science teachers section of the Academy of Science of St. Louis, "How We Would Like You to Prepare the Student for Botany in the University"; December 4, St. Louis Horticultural Society, "Plant Hunting in the Balkans."

Mr. Fred A. Barkley, University Fellow in the Shaw School of Botany: November 27, history of science section of the Academy of Science of St. Louis, "A Résumé of the Use of Drugs in the Treatment of Disease."

Mr. A. P. Beilmann, Arboriculturist to the Garden: February 10, Garden Club of St. Louis, "The Pruning of Shrubbery"; March 6, St. Louis Horticultural Society, "The Fertilization of Trees"; April 10, North St. Louis Business Men's Association, "The Feeding of Trees"; July 8, American Association of State Highway Officials and the Highway Research Board," "Fertilizing of Shade Trees."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden: March 3, St. Louis Wild Flower Club, "Vagabonding in the Southwest"; March 6, Webster Groves Nature Society, Webster Groves, "Vagabonding in the Southwest"; May 18, Topeka Horticultural Society, Topeka, Kansas, "Vagabonding in the Southwest."

Dr. C. W. Dodge, Mycologist to the Garden: September 18, Facultad de Medicina, San José, Costa Rica, "Sobre Algunos Aspectos Clínicos de las Enfermedades Producidas por Hongos"; October 20, Phi Sigma, "Costa Rica"; November 3, travel group of Pilgrim Congregational Church, "Costa Rica."

Dr. David C. Fairburn, Research Assistant to the Garden: February 1, Nurses of Deaconess Hospital, "The Care and Arrangement of Flowers"; February 25, civics group of the St. Louis College Club, "Landscaping the Home Grounds"; May 1, St. Louis Horticultural Society, "Plant Propagation."

Dr. J. M. Greenman, Curator of the Herbarium: January 3, joint session of Section L of the American Association for the Advancement of Science, the History of Science Society, and the St. Louis Academy of Science, "Thomas Nuttall (1786–1859), His Place in the History of American Science"; October 28, Academy of Science of St. Louis, "The Herbarium of the Missouri Botanical Garden."

Mr. L. P. Jensen, Manager of the Garden Arboretum: February 11, Parent-Teachers' Association of Gray Summit, Mo., "The Henry Shaw Gardenway"; March 26, Washington Chamber of Commerce, Washington, Mo., "Roadside Planting"; April 6, Garden Club of Gray Summit, "New and Interesting Trees and Shrubs at the Arboretum"; April 24, Webster Groves High School Students, "Conservation of Native Plants"; April 25, St. Louis Naturalists' Club, "Fifty Years of Gardening and Nature

Study"; May 31, garden clubs of Sullivan and Gray Summit, Mo., "The Interest in Regional Planning by Garden Clubs"; June 10, Garden Club of Rolla, Mo., "The Missouri Botanical Garden Arboretum"; July 7, American Association of State Highway Officials and the Highway Research Board, "The Missouri Botanical Garden Arboretum"; August 9, Greater St. Louis Association of Gardeners, "The History of the Greater St. Louis Association of Gardeners"; August 26, Missouri Federation of Garden Clubs, at Sedalia, "Conservation of Missouri Plant Life"; November 13, Mid-West Section of the National Conference of State Parks, "The Henry Shaw Gardenway"; November 15, the same group, at the Garden Arboretum, "The Missouri Botanical Garden Arboretum"; November 14, Greater St. Louis Association of Gardeners, at its 20th anniversary banquet, "The St. Louis Gardeners and Their Association."

Mr. Paul A. Kohl, Floriculturist to the Garden: February 3, Women's Club of Belleville, Ill., "Roses"; March 25, Garden Club of Rolla, Mo., "Irises, Peonies, and Roses"; October 28, Garden Club of St. Louis, "Hardy Chrysanthemums."

Dr. George T. Moore, Director of the Garden: March 18, Freshman Class of Harris Teachers College, "Henry Shaw and His Gift to St. Louis"; April 20, Brotherhood of Pilgrim Congregational Church, "Flowers that Bloom in the Spring"; April 24, Practical Arts Club of College Women, "My Garden and Yours"; May 1, St. Louis Civitans, "Mr. Shaw and His Garden"; May 18, Garden Club of Louisiana, Mo., "What Goes on in the Plant"; October 29, Men's Club of the Oak Hill Presbyterian Church, "The Missouri Botanical Garden"; November 4, science section of the Wednesday Club, "Henry Shaw, the Greatest Plant Philanthropist"; November 13, Vassar College Alumnae, "Some Activities of the Garden."

Mr. George H. Pring, Superintendent of the Garden: January 5, St. Louis Ladies' Florist Club, "The Evolution of the Chrysanthemum"; January 22, seventh annual Nurserymen's and Landscape Gardeners' Conference, Ohio State University, Columbus, "Water-lilies"; February 4, St. Louis Hills Garden Club, "City Gardens"; March 12, Kappa Delta Sunday School Class of Signal Hill Community Church, East St. Louis, Ill., "Annuals and Peren-

nials for the Garden"; March 23, Art Club, "Henry Shaw and His Garden"; March 30, afternoon, Monday Club of Webster Groves, "Romance of the Plant World"; March 30, evening, Boy Scout Troop 198, "A Trip over the Andes of Colombia"; April 1, Tyler Place Presbyterian Church, "Henry Shaw and His Garden"; April 6, Gray Summit Garden Club, "Judging St. Louis Gardens"; April 7, West Presbyterian Church, "Orchids"; April 14, Bloomington and Normal Garden Club, Bloomington, Ill., "Orchids"; May 6, Young Women's Guild of St. Paul's M. E. Church, East St. Louis, Ill., "Romance of the Plant World"; May 19, Men's Fellowship Club, Edwardsville, Ill., "The Beautification of Home Gardens"; June 9, garden clubs of Herrin, Ill., "Beautifying the Home Grounds"; June 25, fiftieth anniversary banquet of the St. Louis Florist Club, "The Plant Speaks"; September 12, International Horticultural Exposition, Chicago, "Plant Exploration in Central and South America"; October 4, St. Louis Association of Gardeners, "The Effect of Heat and Drought on Plants"; November 14, St. Louis Association of Gardeners, "The Value of the Gardener to the Community"; November 17, Associated Garden Clubs of Kansas, "The Missouri Botanical Garden"; December 16, at noon, West End Kiwanis Club, "The Romance of the Plant World"; December 16, evening, Men's Club of Peters Memorial Church, "Jungle Experiences in Colombia, South America."

Dr. Hermann von Schrenk, Pathologist to the Garden: January 28, American Wood Preservers' Association, Memphis, "Toxicities of Creosote and Other Coal-Tar Products Extracted from Hard-wood Ties which Have Been in Track Twenty Years or More"; April 8, University of Illinois student chapter, American Society of Civil Engineers, Urbana, "College Education and Subsequent Careers"; April 18, Missouri section Society for the Promotion of Engineering Education at Washington University, "Engineering Education."

HERBARIUM

The herbarium has had a successful year. The new steel cases which were installed late in 1935 made it possible to expand the overcrowded portions of the herbarium and to rearrange the ma-

terial of several large families of the apetalous and polypetalous series. Many new and important collections have been acquired during the year.

Some of the more important collections obtained are the following: E. Anderson, miscellaneous duplicates, 89; F. A. Barkley, miscellaneous duplicates, 113; Botanical Institute, Bacou, U. R. S. S., 150 plants of Transcaucasia; Botanical Museum, University of Cluj, 313 plants of Roumania; Brooklyn Botanic Garden, 217 plants of the eastern United States; B. F. Bush, 1,100 plants of Missouri, Arkansas, and Oklahoma; California Academy of Sciences, 76 plants of California; Carnegie Museum of Pittsburgh, 533 plants of the Uinta Basin, Utah; Mrs. Carr, 259 plants of Germany; Otto Degener, 163 plants of Hawaii; James de Gruchy, 58 plants of Oklahoma; Delzie Demaree, 371 plants of Ohio, Oklahoma, and Arkansas; C. W. Dodge 2,232 plants of Costa Rica; J. A. Drushel, 140 plants of the eastern and central United States; Duke University, 200 plants of North Carolina; C. F. E. Erichsen, 300 lichens of Germany; Field Museum of Natural History, 103 miscellaneous duplicates; Howard Scott Gentry, 410 plants of Mexico; F. A. Gilbert, 100 plants of West Virginia; E. H. Graham, 45 plants of Utah; Gray Herbarium of Harvard University, 735 plants from the eastern United States, Cuba, and Brasil; J. L. Gressitt, 400 plants of Hainan Island, China; H. Happeman, 226 plants of Colorado and Nebraska; R. A. Harper, 95 plants of Alabama, Mississippi, and Louisiana; Bertrand Harrison, 223 plants of Utah; F. J. Hermann, 137 plants of Michigan; G. E. Hinton, 205 plants of Mexico; David Keck, 124 plants chiefly of California; Ellsworth P. Killip, 403 plants of Peru, collected by G. Klug; B. A. Krukoff, 366 plants of Sumatra; Maude Lodewyks, 51 plants of Missouri, Illinois, and Tennessee; C. L. Lundell, 90 plants of British Honduras and Guatemala; Bassett Maguire, 214 plants of Utah and Arizona; J. A. Moore, 95 plants of Missouri and Wisconsin; Morris Arboretum, 350 plants of the eastern United States; New York Botanical Garden, 52 plants of Florida; Ben Osborn, 170 plants of Nebraska; H. Pittier, 104 plants of Venezuela; Riksmuseet, Stockholm, 491 plants of Scandinavia and South America; Edith Purer, 124 plants of California; R. J. Seibert, 436 plants of Pan-

ama; J. C. Shirley, 121 plants of Oklahoma; Alexander F. Skutch, 411 plants of Costa Rica; Stanford University, 89 plants of California; Julian A. Steyermark, 4,150 plants of Missouri; United States Department of the Interior, National Park Service by A. E. Demaray, 150 plants of Platte National Park; United States National Museum, 113 plants of South America; University of California at Los Angeles, 172 plants of California, Arizona, and Nicaragua; University of Denver, 211 plants of Colorado; University of Oklahoma, 496 plants of Oklahoma; Frans Verdoorn, 200 mosses and hepatics; Hermann von Schrenk, 194 plants of Colorado and Texas; Louis O. Williams, 3,175 plants mostly from northwestern United States; F. Lyle Wynd, 639 plants of Mexico.

Mounting and Insertion of Specimens.—The mounting and inserting of new material has continued steadily throughout the year, so that most of the specimens received are now incorporated in the general herbarium. Eighteen thousand one hundred and twelve (18,112) specimens of new material have been added to the permanent collections during the year.

The reorganization of collections already in the herbarium in the light of revisions, monographs, and current literature has received due attention and much time has been devoted to this important work. Numerous families have been thoroughly reorganized. Among these are the following: Betulaceae, Ulmaceae, Moraceae, Urticaceae, Proteaceae, Chenopodiaceae, Amarantaceae, Menispermaceae, Magnoliaceae, Anonaceae, Monimiaceae, and Theaceae.

Exchanges.—The exchange of duplicate herbarium specimens has always been an important means of building up a general herbarium. During 1936 the Herbarium of the Missouri Botanical Garden has received on the basis of exchange four thousand seven hundred and twenty-seven (4,727) specimens. In the same period three thousand four hundred and fourteen (3,414) duplicate specimens have been sent to correspondents. These exchanges, it is felt, are of mutual advantage.

Field Work.—Again a considerable amount of field work has been carried on during the year by members of the staff and students. Important new material has been obtained in this manner

although all of it has not yet been sorted over, named, and incorporated in the general herbarium. Some of it will include important duplicate material for exchange.

Use of the Herbarium.—The use of the herbarium is ever increasing by those visiting the Garden to make identification by comparison with authentically named material and by those borrowing material in connection with taxonomic research. Inter-herbarium loans, like inter-library loans of books, have greatly extended the opportunity for research which otherwise would be either impossible or limited to the favored few.

Statistical Summary (for the year ending December 31, 1936):

Number of specimens acquired on new accessions:

By purchase	11,814
By gift	2,834
By exchange	5,696
By transfer	60
By field work	2,252
Total	22,656

Number of specimens mounted and incorporated	18,112
Number of specimens discarded	115
Number of specimens in unorganized herbarium	124,937
Number of specimens in organized herbarium	1,097,472

LIBRARY AND PUBLICATIONS

The amount spent for books and serials during the year was considerably less than in 1935. The catalogues of botanical works were tempting, but little was offered which was absolutely needed by the library, and the number of purchases by this means was small. The decrease in the price of German publications too may partly account for the smaller outlay. In spite of the smaller expenditure, however, the number of library accessions was greater. Several new serials were started during the year, and some have resumed publication, these being received in exchange for the ANNALS. There were also more pamphlets coming in, both from libraries and authors.

The work of moving the books in the main periodical section to the old lecture-room is being done gradually, as time permits, and it may be another year before the shift is completed. About one-third of the books in the old lecture room have been cleaned and re-labelled and the work is still going forward.

New Accessions.—Perhaps the most noteworthy purchases of 1936 were Wawra's "Botanische Ergebnisse der Reise Maximilians I nach Brasilien," a work published in 1866; six volumes of "Archiv für Mikrobiologie"; and 2,000 cards of Tilden's "Index Algarum." Gurney Wilson, the Garden representative in Europe, continues to send library material from time to time, and among that received during the year were five packages of rare old seed-catalogues, and some flower plates from Curtis's "Botanical Magazine" and Edwards' "Botanical Register." Several new serials were received in exchange for the ANNALS: "Notulae Systematicae" which has resumed publication; "Journal of the Southern Appalachian Botanical Club"; "Biodynamica"; "Bulletin de l'Institut et du Jardin Botaniques de l'Univ. de Beograd," etc. Among the donations worthy of mention were 162 pamphlets from the John Crerar Library consisting of reprints, monographs, theses, old seed-catalogues, and seed-lists. The Mercantile Library donated twenty-three volumes of the "Botanical Gazette," "Hooker's Journal of Botany," Vols. 1–4, Auerswald, "Botanische Unterhaltungen zum Verstandniss der heimatlichen Flora," and several other important botanical works.

The following are some of the other noteworthy library accessions received during the year: Ascherson & Graebner, Synopsis der mitteleuropäischen Flora. Lief. 130–132; Beeli et Goossens-Fontana, Flore iconographique des champignons du Congo. Fasc. 1: Bowers, Rhododendrons and azaleas, their origin, cultivation and development; Braun-Blanquet und Rübel, Flora von Graubünden. Lief. 1; Buchanan and Fulmer, Physiology and biochemistry of bacteria. vols. 2 and 3; Burgeff, Samenkeimung der Orchideen und Entwickelung ihrer Keimpflanzen; Burtt-Davy, A manual of the flowering plants and ferns of the Transvaal; Chronica Botanica. vol. 2; Collection académique composée des memoires, actes ou journaux des plus célébres acad. et soc. lit. etrangeres. Vols. 1, 3, 4, 6–13; Coutinho, Basidiomicetas novas para a flora de Portugal. pt. 2; Engler, Das Pflanzenreich regni vegetabilis conspectus. 101 (IV 20), Lief. 2, 3, and 4; Engler's Syllabus der Pflanzenfamilien. ed. 2; Engler & Prantl, Die natürlichen Pflanzenfamilien. ed. 2, vol. 17; Ergebnisse der Enzymforschung. vol. 5; Flora of Trinidad and Tobago. vols. 1 and 2;

Flowering plants of South Africa. vol. 16, nos. 61–63; Grove, A supplement to Elwes' monograph of the genus Lilium. pts. 3 and 4; Janssonius, Mikrographie des Holzes auf Java vorkommende Baumarten; Kanjilal, Kanjilal, and Das, Flora of Assam. vol. 1 and continuation; Killermann, Pilze aus Bayern. Kritische Studien bes. zu M. Britzelmayr. Bd. 20, Teil VI; Komarov, Flora U. R. S. S.; Lange, Flora agaricina Danica. vol. 1. pls. 1–40; Merrill, A commentary of Loureiro's "Flora Cochinchinensis"; Möller, Hausschwammforschungen. Hefte 10–11; Nakai et Kitagawa, Plantae novae Jeholenses; Oppenheimer, Die Fermente, Supplement vols. 1 and 2; Pascher, Die süsswasser Flora Mitteleuropas. Heft 15; Plotnikow, Allgemeine Photochemie; Pringsheim, Julius Sachs, der Begründer der neueren pflanzen Physiologie; Rabenhorst, Kryptogamenflora. Band IX, Abt. 1, Teil II, Lief. 1; Abt. 2, Teil I, Lief. 1; Abt. 5, Teil I. Leif. 2, 3; Teil III, Lief. 1–2; Raunkiaer, The life forms of plants and statistical plant geography; Ricord-Madianna, Recherches et experiences sur les poisons d'Amerique, tires des trois regnes de la nature; Schimper, Pflanzengeographie auf physiologischer Grundlage; Schuchert, Historical geology of the Antillean Caribbean region; "Southern Cross" Report on the collections made in the Antarctic regions; Spruce, Hepaticae of the Amazon and of the Andes of Peru and Ecuador; Troll, Vergleichende Morphologie der höheren Pflanzen; Wawra, Botanische Ergebnisse der Reise Maximilians I nach Brasilien (1859–60); Wodehouse, Pollen grains, their structure, identification and significance in science and medicine; Wollenweber-Reinking, Die Fusarien, ihre Beschreibung, Schadwirkung und Bekämpfung; World list of scientific periodicals published in the years 1900–33. 2nd ed.

When Mr. Paul Allen went to the Canal Zone as Manager of the Garden Tropical Station, several important botanical works were purchased or bound for his use. Among these were a set of Bailey's "Standard Encyclopedia" and of "Gentes Herbarum," some Standley's works on tropical floras, the Missouri Botanical Garden publications, etc.

Garden Publications.—The work of editing the two Garden journals, the ANNALS and the BULLETIN, is largely done by the librarian. Volume XXIII of the quarterly ANNALS, consisting of

662 pages and 29 plates, was completed during the year. The BULLETIN, as usual, was issued monthly except July and August, the volume (Volume XXIV) containing 243 pages and 46 plates, 19 text-figures, and 1 map. The map was a supplement to the June number which consisted of a single article by Dr. Anderson, "A Tour of the Missouri Botanical Garden," describing the various gardens and conservatories. Reprints of this article were published and are on sale to tourists, visitors from schools, etc., to be used as a guide to the Garden.

There are 415 foreign and 127 domestic institutions exchanging their publications for the ANNALS, and 47 foreign and 58 domestic institutions exchanging for the BULLETIN. Seven new names were added to the ANNALS list during the year from various foreign countries—Argentina, Germany, Netherlands, Yugoslavia, Philippine Islands, Sweden, New Zealand. In August about 1,200 reprints from the ANNALS were sent to 250 botanists in this country and abroad in exchange for their publications. The ANNALS and BULLETIN are also sent on subscription, the cash receipts during the year from sales of all Garden publications being over $1,800. Heretofore, the majority of the BULLETINS have been sent gratis to schools, flower-growers, friends of the Garden, etc., but due to the decreasing income of the Garden this practice will be discontinued in January, 1937, and the publication will be sent only to those paying the price of subscription, one dollar a year.

Use of the Library.—In addition to the staff and students in the Shaw School of Botany, the following out-of-town botanists have consulted the library during the year: Mr. H. W. Alberts, Associate Agronomist, Soil Conservation Service, Edwardsville, Ill.; Dr. Caroline K. Allen, Assistant in the Herbarium, Arnold Arboretum, Boston, Mass.; Dr. Ralph W. Chaney, Research Associate, Carnegie Institution of Washington, and Professor of Palaeontology, University of California, Berkeley; Dr. Jens Clausen, of the Carnegie Institution of Washington, Leland Stanford University, Calif.; Dr. Delzie Demaree, of the University of Oklahoma, Norman; Dr. J. A. Drushel, Professor of Education, New York University, New York; Dr. W. H. Emig, Assistant Professor of Biology, University of Pittsburgh; Professor A. T. Erwin, Associate Professor of Horticulture, Iowa State College, Ames;

Dr. Norman C. Fassett, Assistant Professor of Botany, University of Wisconsin, Madison; Dr. R. A. Fisher, of the Galton Laboratory, University of London, England; Mr. Reginald Forwood, Mycologist, of Minett, Canada; Mr. C. E. Foweraker, Lecturer on Forest Ecology, Canterbury College, Christ Church, New Zealand; Dr. Harry J. Fuller, Associate in Botany, University of Illinois, Urbana; Mr. L. O. Gaiser, of McMaster University, Hamilton, Ontario; Dr. Milton Hopkins, Instructor in Botany, University of Oklahoma, Norman; Mr. Hurst T. John, Landscape Architect, Stephens College, Columbia, Mo.; Dr. Erzsebet Kol, Professor of Botany, University of Szeged, Hungary; Mr. John Marr, Teaching Assistant in Botany, Northwestern University, Evanston, Ill.; Dr. C. E. Moore, Head, Department of Biological Science, State Teachers College, Memphis, Tenn.; Dr. Joseph O'Mara, of the Missouri Agricultural Experiment Station, Columbia; Mrs. Wilhelm Munthe, of Oslo, Norway; Dr. E. E. Naylor, Assistant Professor of Botany, University of Missouri, Columbia; Dr. H. W. Rickett, Associate Professor of Botany, University of Missouri, Columbia; Dr. W. O. Richtmann, Professor of Pharmacy, University of Wisconsin, Madison; Dr. F. J. Scully, of Hot Springs, Ark.; Dr. Ernest Sears, of the Missouri Agricultural Experiment Station, Columbia; Dr. Paul B. Sears, Head, Department of Botany, University of Oklahoma, Norman; Dr. Earl E. Sherff, Head, Department of Science, Chicago Normal College; Mr. J. C. Shirley, Head, Department of Biology, Phillips University, Enid, Okla.; Dr. Forrest Shreve, in charge, Desert Laboratory of the Carnegie Institution of Washington, Tucson, Ariz.; Dr. Marion Parris Smith, of Bryn Mawr College, Bryn Mawr, Pa.; Dr. Naomassa Shimotomai, Professor of Botany, Hiroshima University, Hiroshima, Japan; Miss P. Snure, Teaching Assistant in Botany, University of Wisconsin, Madison; Dr. R. A. Studhalter, Professor of Biology, Texas Technological College, Lubbock; Miss Bonnie Templeton, Botanist at the Los Angeles Museum, Los Angeles, Calif.; Dr. Fr. Verdoorn, Editor *Annales Bryologici* and *Chronica Botanica,* Utrecht, Holland; Dr. Robert W. Webb, Senior Cotton Technologist, Bureau Agricultural Economics, U. S. Dept. Agr., Washington, D. C.; Mr. Louis C. Wheeler, Assistant in the Gray Herbarium of Harvard University,

Cambridge, Mass.; Dr. Thomas W. Whitaker, Associate Geneticist, U. S. San Diego Acclimitization Gardens, Torrey Pines, La Jolla, Calif.; Dr. I. L. Wiggins, Assistant Professor of Botany and Curator of the Dudley Herbarium, Leland Stanford University, Calif.

The following groups visited the library during the year: botany class, University of Missouri, in charge of Dr. H. W. Rickett, Assistant Professor of Botany; two groups of students from the Junior College, Flat River, Mo.; the senior class of Monticello Seminary, Godfrey, Ill.; botany classes from the Principia College, Elsah, Ill.; and botany classes from Washington University.

The library also loans books on the inter-library plan, and 182 such loans were made to 25 institutions during 1936.

Statistical Information.—There have been donated to the library or received in exchange during the year 613 books valued at $1,624.44, 1,877 pamphlets valued at $266.83, and two manuscripts valued at $2.00. Two hundred and seventy-two books were bought at a cost of $2,181.26, and 75 pamphlets at a cost of $82.75. The library now contains 51,239 books and 78,257 pamphlets. There are 337 manuscripts valued at $1,639.40, and 1,031,427 index cards valued at $12,762.43. A total of 9,220 cards were added during the year, of which 1,394 were written by Garden employees, and 7,826 were purchased at a cost of $156.48. Four hundred and thirty-two books were bound.

George T. Moore,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1936

GARDEN ATTENDANCE:

Total number of visitors	22,124

LIBRARY ACCESSIONS:

Total number of books bought	7
Total number of books and pamphlets donated	73

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	13

HERBARIUM ACCESSIONS:

By Purchase—	
Harper, Roland M.—Plants of Alabama, Mississippi, and Louisiana	85
Steyermark, Julian A.—Plants of Missouri	4,150
By Gift—	
Ames, Lawrence—*Magnusia brachytricha* Ames	1
Anderson, E.—Miscellaneous herbarium specimens	21
Baker, G. E.—*Teloschistes polycarpus* (Ehrh.) Tuck. from Wisconsin	1
Barkley, F. A.—*Azolla caroliniana* Willd. from Illinois	7
Cutler, H.—*Rhus canadensis* Marsh, from Missouri	1
Fuller, George D.—Plants from Saskatchewan	2
Malençon, G.—*Secotium arizonicum* Griff. & Shear from Morocco	1
Mounce, Irene—*Cantharellus multiplex* Underw. from Quebec	1
Rumbold, Caroline T.—Fungi	7
Seibert, R. J.—Plants of Panama	32
By Exchange—	
Ames, Oakes—Illustrations from "Orchidaceae"	15
Brooklyn Botanic Garden—Plants of eastern United States	217
California Academy of Sciences—Plants of California	76
Gray Herbarium—Plants of Virginia	79
Stanford University—Plants of California	89
U. S. National Museum—Plants of South America	97
University of Oklahoma—Plants of Oklahoma	396
By Transfer—	
Fairburn, David C.—Plants of Horticulture	6
Missouri Botanical Garden—Photographs of *Castilleja*	20
By Field Work—	
Dodge, Carroll W.—Plants of Costa Rica	2,200
Total	7,501

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV FEBRUARY, 1937 No. 2

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OF THE MISSOURI BOTANICAL GARDEN

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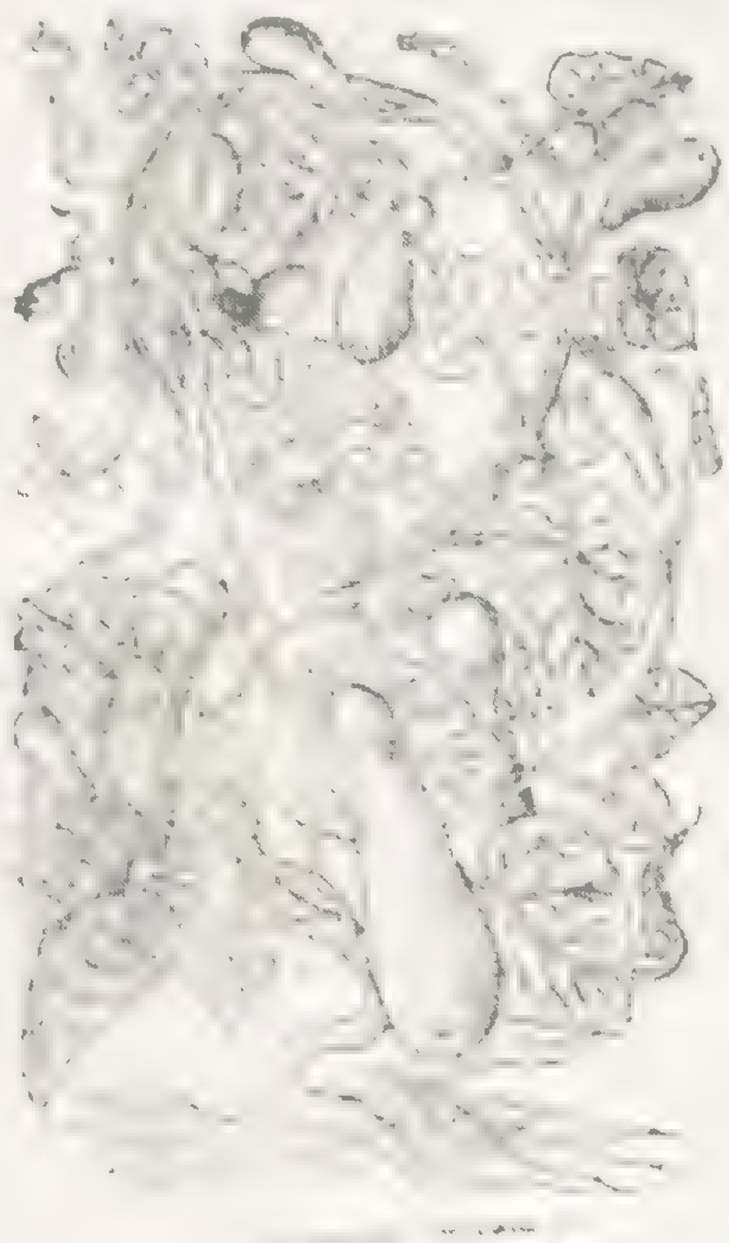
HISTORIE OF PLANTS. 777

1 *Cucurbita anguina.*
Snakes Gourde.



2 *Cucurbita lagenaria.*
Bottle Gourdes.

The description.

1 THe Gourde bringeth foorth very long ſtalks, as be thoſe of the Vine, cornered and parted into diuers branches, which with his claſping tendrels taketh holde and climeth vp vpon ſuch things that ſtande neere vnto it: the leaues be very great, broad, and ſharpe pointed, almoſt as great as thoſe of the Clote Burre, but ſofter, and ſomewhat couered as it were with a white creeſe, as be alſo the ſtalks and branches, like thoſe of the Marſh Mallowe: the flowers be white, and groweſoorth from the botome of the leaues: in their places come vp the fruite, which are not all of one faſhion; for ſometimes they haue the forme of flagons, or bottles, with a great [illegible] The Gourd [illegible] in his 19 [illegible] chapter, groweth [illegible] forme or faſhion that you would haue it, either like vnto a wreathed dragon, the legge of a man, or [illegible] chimbe vpon an arbor where the fruite may hang, it hath beene ſeene to be nine foote long, by reaſon of his great waight which hath ſtretched it out to the length: the rinde when it is ripe, is verie hard, [illegible] and [illegible] the ſeede lieth, [illegible] top, broade below, with two pikes hanging out like horns, white within, and ſweete in taſte.

2 The ſecond differeth not from the precedent in ſtalkes, leaues, or flowers: the fruite hereof is [illegible] like a bottle or flagon, whereof [illegible] the difference.

The place.

[illegible] in the gardens of theſe cold regions, rather for pleaſure then [illegible] fit; in the hoe countries where they come to ripeneſſe, they are ſometimes eaten (but with ſmall delight:) eſpecially they are kept for the rindes, wherein they put Turpentine, Oile, Honie, and alſo ſerue them for pailes to fetch water in, and many other the like vſes.

The

COPY OF PAGE FROM GERARDE'S "HERBALL," 1597, GIVING ILLUSTRATIONS AND DESCRIPTIONS OF GOURDS

Missouri Botanical Garden Bulletin

Vol. XXV FEBRUARY, 1937 No. 2

ORNAMENTAL GOURDS

Gourds have been used from time immemorial for various utilitarian purposes. Such gourds have been the hard-shelled kind which last indefinitely as long as they remain dry. Some of the fruits are edible, which associates them with the cucumbers and melons, but this article concerns only the decorative types. The dipper gourd is familiar, but the more grotesque types, like the dolphin gourd, are seldom seen. Botanists have endeavored to establish the original habitat of the various Cucurbita but to no avail. Some of them were grown by the Egyptians, the Greeks, and the Romans. Even in those days, as now, gourds were forced to grow into fantastic shapes by putting them into moulds when quite young or tying bandages around them during their growth.

At the Garden library the first reference to Cucurbita appears in a work by "de Crescentiis" printed in 1474, just nineteen years after the invention of printing. The first illustration of a gourd vine is a wood-cut of a bottle gourd in *"Herbarius Latinus"* published in Mainz, Germany, 1484. *"Ortus Sanitatis,"* printed in Venice in 1511, also contains a drawing of a bottle gourd. Leonhartus Fuchsius in *"De historia stirpium commentarii insignes,"* 1542, illustrates the large and small bottle gourds. Gerarde in his *"Herball"* of 1597 mentions the bottle and other gourds. Parkinson in *"Theatrum Botanicum,"* published in 1640, illustrates and describes at length the various gourds and in his *"Paradisi in Sole,"* 1629, he describes the pumpkin. All through the centuries gourds have changed very little, if any, as their descriptions and uses by these early herbalists may be applied to the present-day varieties.

Prof. A. T. Erwin, of Iowa State College, in *Science,* May 9, 1930, tells of the recovery from the Cliff Dweller ruins of seeds and fragments of the rind and peduncle of Cucurbita. These materials were collected by Messrs. Kidder and Guernsey and are now at the Peabody Museum of Harvard. According to Kidder, these specimens are from the Basket Makers, who antedated the Cliff Dwellers, and belong to the period 2000 to 1500 B. C.

The North and South American Indians have always used gourds in their tribal dances and as utensils. The colonists and pioneers had their gourds and the mountaineers and negroes in the South are seldom without them.

Dr. L. H. Bailey in *Gentes Herbarum,* Vol. 11, "The Domesticated Cucurbitas," states that the "pumpkins and squashes, as we now understand them, are unknown in a native wild state. This is one of the enigmas in the plant world." These squash-like pumpkins hybridize so freely that the variation in size, shape, and color is endless. But in speaking of gourds one likes to think more of the ornamental kinds which give so much pleasure by their rapid growth, their interesting yellow and white flowers, the rapid development of the odd-shaped fruits, and finally the harvest in the fall for exhibition, decoration, or utilitarian purposes, as dippers, bowls, boxes, bird houses, nest-eggs, darning balls, rattles, door-stops, and sponges.

Gourds in the United States.—In the first American seed broadside still extant, printed between 1790 and 1804 by Bernard M'Mahon of Philadelphia, gourds are described thus:

> "Warted gourds (with a great variety of other kinds) . . . . Cucurbita verrucosa"

Dreer's catalogue in 1875 listed the "calabash, Hercules' club, egg-shaped, mock orange, powder horn, Argyrosperma from Texas, also known as the Bonnet Gourd, and Trichosanthes colubrina (true serpent gourd)." In addition to the above varieties, Burpees' "Farm Annual" of 1882 described the miniature bottle-shaped, orange, angora, and sipho gourds. By the turn of the century most seed catalogues listed gourds separately and in mixtures.

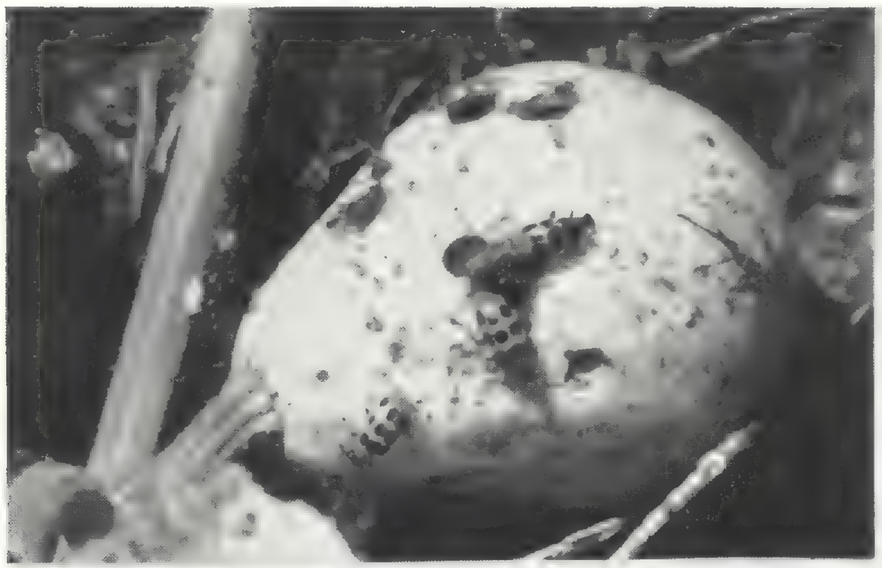
Referring to a representative horticultural periodical, *The Gar-*

GOURD VINE SHOWING STAMINATE AND PISTILLATE FLOWERS, TENDRILS, AND FRUIT

BOTTLE GOURDS ON TRELLIS

den Magazine, published by Doubleday, Page and Company from February, 1906, to February, 1925, we find some good pictures accompanying an article in the issue of May, 1906. Except for two minor articles in later years, that was the only major description of gourds in twenty years. Continuing with another current gardening paper, *Horticulture,* which was taken over by the Massachusetts Horticultural Society for its first issue on August 1, 1923, we attempt to trace the mounting interest in gourds which at the present time is becoming a fad. In *Horticulture,* August 15, 1929, the first mention of gourds refers to Leaflet 36 of the Department of Agriculture, which describes "Gourds for Bird Houses." The next item appeared in the March 15, 1934, issue which gave some history and the method of decorating gourds. On December 1, 1934, *Horticulture* told of a gourd exhibit at the New York fall flower show and later at the New York Botanical Garden through the courtesy of Miss Helen M. Tillinghast of "The Gourd-Vine," Vernon, Connecticut. Incidentally Miss Tillinghast in 1936 published a pamphlet on gourds entitled "The First Gourd Book." Again, on December 15, 1934, *Horticulture* announced the formation of the International Gourd Society on the West Coast. Several other articles appeared in *Horticulture* in 1935 and 1936. Mrs. James E. Gregg gives an interesting history of gourds in the May, 1935, *Bulletin of the Garden Club of America.* Still more American gardening journals could be cited for their gourd articles, which is sufficient proof of the present popularity of such plants. Quite apart from any previous interest in gourds a new vogue has been started of using them as decorative material, the idea having probably originated from the Indians and Mexicans. Patio strings are now very popular. Shop windows in the East or West display gourds or a department store will offer for sale many gourd novelties in the gift shops. Highly colored bowls, boxes, patio strings, plaques, assorted small kinds in bowls, dippers, bird houses, lamps whose bases are large gourds, are all arranged to tempt the shopper. In South America gourds are sometimes carved and then burnt with hot needles, like the one from Peru pictured in plate 7.

Gourd Hobby.—There is a great amount of fascination attached to the growing of gourds for ornamental purposes. An entire year



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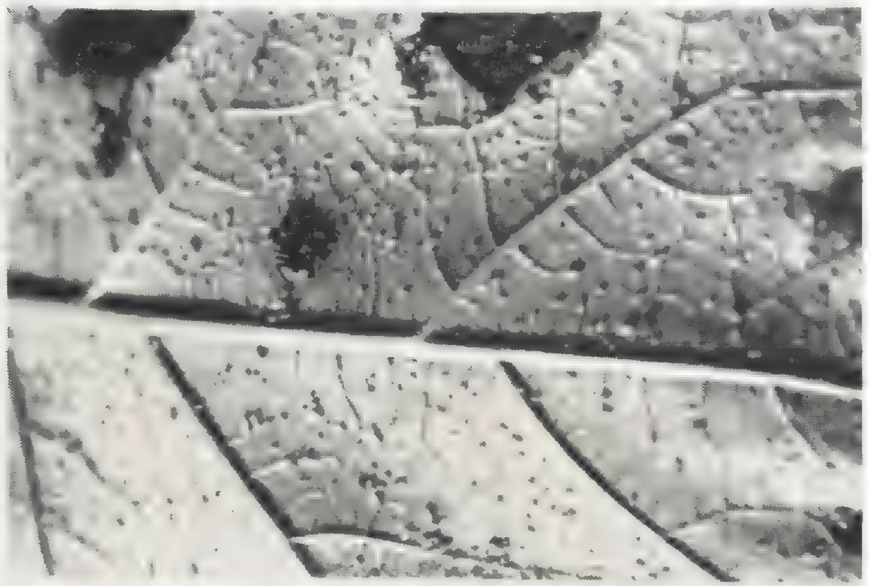


4

GOURD INSECTS

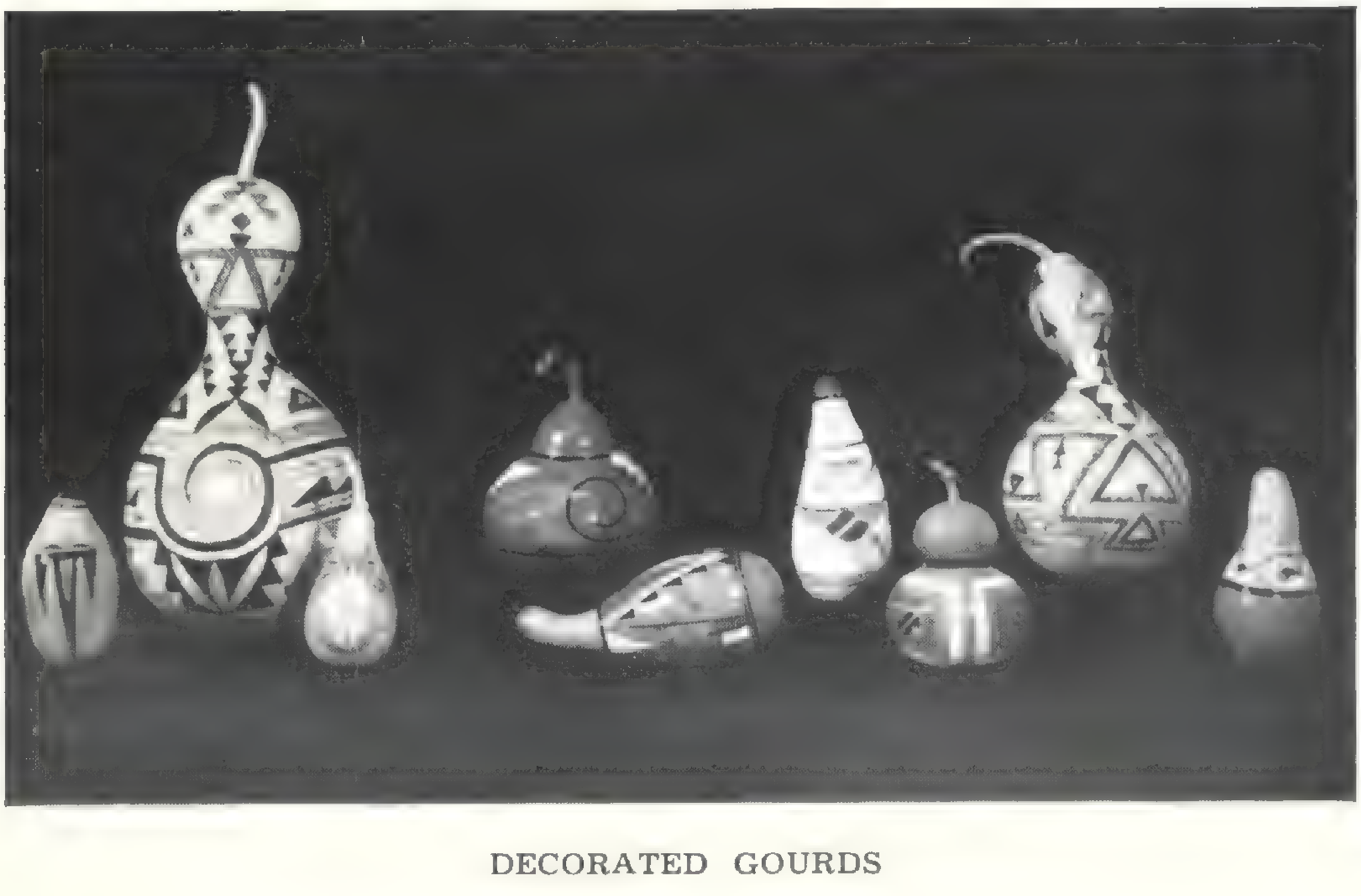
1. Twelve-spotted cucumber beetles. 2. Striped cucumber beetle. 3. Squash bugs. 4. Melon Aphis.

may be occupied during leisure moments to pursue this hobby. With the beginning of the year seed catalogues and gardening journals must be consulted until the proper assortment has been assembled. Practically all annual seed catalogues describe some gourds but frequently only the commonest kinds, like the dipper gourd or mixtures, are listed. To find firms selling the rarer dolphin, crown of thorns, or Turk's turban, requires more diligent searching. Early in the year the soil is prepared; seeds are sown in April and May; trellises are built; insects are fought and the plants are watered and fertilized during the summer; the gourds are gathered in the fall and dried; and polishing and decorating will occupy many an hour during the fall and winter months.

Trellises.—Some thought should be given to the selection of varieties to be grown in the garden. Almost all of the gourds are very rapid-growing vines and in a short time will cover large areas. The type of support and the amount of room available will govern the number that may be grown. Any type of fence will serve as a trellis or brush supports may be used. Chicken netting is an excellent material except for the fact that unless the developing fruits are guided through the netting some of them may be caught in one of the meshes and be deformed. Gourd vines may be allowed to run over the ground and such vines will develop good fruits, but many of them, like the large bottle gourds, will not be symmetrical if left lying on their sides. Conversely, some of the odd-shaped kinds like the dolphin and calabash will develop their peculiar crooked necks only if left on the ground. Everything considered, however, it is better to grow the large-fruited gourds on some trellis rather than to let them mature on the ground.

Types to Grow.—If a variety of gourds is grown for fall exhibitions then both hard and soft-shelled kinds should be included. If gourds are wanted for painting and decorating and to be kept indefinitely then only the hard-shelled varieties should be selected. There are a few odd kinds that may even be eliminated from any seed list because they are practically worthless. One such gourd, known as the ornamental pomegranate, produces a fruit about the size of an orange. It is very heavily scented but when fully ripe lasts for only a week or two in mid-summer. Good seed catalogues

COLLECTION OF GOURD FRUITS



DECORATED GOURDS

divide the gourds into small- and large-fruited kinds. The small gourds are almost all of the hard-shelled type and make excellent filler material for the patio strings. In the large-fruited section are several varieties having the consistency of a pumpkin but these may not be kept for any great length of time. Examples of this kind are the acorn, bishop's mitre, and Turk's turban.

Location and Soil.—Gourds should be grown where they may receive sunshine during the entire day. Any good soil where other plants have previously been grown successfully will support a crop of gourds. If well-rotted manure is procurable a shovelful should be worked into each hill where the vines are to be grown. Manure is not essential but is good material to have when available. Leaf-mold or any decayed vegetable matter will also improve the soil. Gourds require fertile but not excessively rich soil. Too much food will produce a rank growth which retards fruit formation. When no manure is available gourds should have some commercial fertilizer worked into the soil at the time it is spaded and once or twice during the growing season. Not more than a heaping tablespoonful of a complete fertilizer should be applied to each gourd vine at any one time. Over-fertilization will produce lush foliage at the expense of fruit.

Sowing the Seeds.—Gourd seeds should be sown outdoors in late April or during the first half of May in this locality, depending upon the weather. They may be started indoors about the middle of April by sowing three or four seeds in a four-inch pot of sandy soil. When the plants are up thin to one or two in each pot. In a room temperature of 70 to 75° most varieties will germinate within a week. It is not necessary first to soak the seeds for twenty-four hours as is sometimes suggested. The pots of plants should be set outdoors on all warm days to strengthen them, and never permit them to wilt for lack of water. The germination of seeds sown directly in the open may be hastened by placing a flower-pot or some other type of plant protector over each group of seeds. After the seedlings are up they may also be shielded from the cold with these same protectors. Gourds are warm-weather plants but they rebelled at the torrid heat of 1936.

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3

1. TURK'S TURBAN GOURDS. 2. DISH-CLOTH GOURDS.
3. HERCULES' CLUB

Watering.—The vines grow very rapidly, and should drought conditions prevail they should have an ample water supply especially at the time when the fruits are swelling. When watering the gourd vines do not drench them with water as much of the pollen will be ruined and the insects discouraged if the open flowers are wet. It is remarkable how quickly gourd fruits develop once they have been fertilized.

Insects.—Except for watering, an occasional fertilizing, and guiding any unruly vines, nothing more would have to be done until harvest time were it not for the plentiful supply of insects that make life miserable for the gourds. Wherever gourds are grown the insects that attack the melon crops will also be found. Melon aphis or plant lice make their periodic visits but their control should present no problem if the vines are sprayed with some nicotine or pyrethrum insecticide. The striped and the twelve-spotted cucumber beetles can become serious pests and do much damage to flowers and fruits if not discouraged. They also are the carriers of the bacterial wilt diseases which attack the cucurbits, and both insects are masters in the art of eluding the helpless gardener. One could almost accuse them of giving the gardener the "ha-ha" in making their rapid exit when they distinguish the difference between the waving of a leaf in the breeze and the approach of a human being. It is impossible to eradicate them, as in the case of the aphis, but it is possible to check them to some extent by the use of repellents and poison sprays. Arsenate of lead sprayed on the foliage will kill some of the insects on the leaves but many of them feed on the flowers which it is impossible to keep coated with the poison spray. Dusting the plants with one part arsenate of lead to eight parts hydrated lime is about the most satisfactory repellent. Calcium arsenate is also an effective dusting material when used in the proportion of one part calcium arsenate to nine parts hydrated lime. This dusting must frequently be repeated, especially after showers.

The squash bug is another elusive insect that can do much damage by inserting its beak into the fruit and vine. While the cucumber beetles fly away when disturbed, the squash bug drops to the ground and plays possum. When the danger is past he slowly finds his way back to the vines. Colonies of squash-bug

1

2

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4

DECORATIVE GOURDS

1 and 2. Plaques displayed in a Santa Fe Hotel. 3. Bottle gourds at Boone Tavern, Berea, Ky. 4. Decorated Peruvian gourd

nymphs may be seen on the leaves after hatching, and as they increase in size they hide on the underside of the leaves and on the stems. These hard-shelled insects are practically impervious to any insecticide except in the early nymph stage when a nicotine solution will kill some of them. The squash bug sucks the plant juices, causing wilting of the vines, and on that account no arsenical spray will poison them. The only means of control consists in crushing the eggs and nymphs and dusting the vines with the same repellents suggested for the cucumber beetles. Dispose of all of the vines in the fall by burning and clean the place of all litter where the plants have grown as all of these insects hibernate in the adult stage. If possible, grow the gourds in a new location each year.

Gathering and Drying Gourds.—Gourds will require the full growing season to bring them to maturity, and the fruits should be left on the vines as long as possible. Types such as the acorn and Turk's turban should be gathered before frost, but the hard-shelled varieties and the dish-cloth gourd will be benefited by freezing which hastens the drying process. Dish-cloth gourds that were frozen in nine-degree weather, in early December, were completely dry in ten days after bringing indoors, while those from the same vines brought in before frost in October were still green. Gourds from the same vines left growing on the ground and frozen decayed soon after harvesting due to their greater moisture content and uneven development. When the fruits are harvested they should be cut from the vine with pruning shears, leaving a two-inch stalk attached. They should be handled carefully as any bruise will be the source of infection. As previously stated, frosts will hasten the drying process of some varieties.

Gourds that are brought indoors should be wiped with a dry cloth and then hung up or placed in baskets not more than one layer deep. Varieties vary greatly in the length of time required to dry thoroughly. When a gourd is entirely dry the seeds rattle. One that feels cool and clammy when held, even though light in weight, is not completely dry. In the process of drying some gourds become covered with various moulds. These mould spots are objectionable if a gourd is to be varnished or stenciled with a design. To help prevent the moulds from forming, the gourds

PATIO STRINGS

should be rubbed with some antiseptic. On the other hand, frequently these spots describe various patterns which when waxed or varnished are very interesting. Moulds on the hard-shelled gourds hasten the drying process. Before the gourds are to be painted they should be scrubbed with a brush and water and dried. If the surface is still somewhat rough it should be rubbed with pumice or steel wool, but not sandpaper as that scratches.

Decorating Gourds.—The manner in which gourds may be decorated is a matter of individual choice. Quick-drying enamels in solid colors may first be applied, followed by designs in contrasting colors. Gourds with clear surfaces may have interesting patterns drawn on them with pencil and then the design burned in with an electric needle or stylus from one of the popular wood-burning sets. After the pattern has been burned the gourd may be waxed or shellacked. In choosing designs for decoration many interesting ideas may be gleaned from the various arts and crafts publications. Since the use of gourds is closely associated with Indian lore it is only natural to turn to the red man's patterns found in rugs, blankets, and pottery. The Indian's symbols for clouds, rain, bear and deer tracks make very interesting designs. When gourds are to be hung on the wall, individually or in patio strings, they should not be tied by the peduncle as this frequently breaks off. Burn a hole through the neck of the gourd and insert a thin wire by which it is then suspended. To do this take a hat pin or any large pin, hold it with a pair of pliers over a gas flame and when red hot slowly push it through the gourd. This may have to be repeated several times. The patio strings are made by tying the different-sized gourds to a central strand. A larger gourd is usually placed at the end, but this is all a matter of personal taste. It will be found that the appearance of the patio string may be improved by adding some seed-pods along the central strand. For contrast these may be left natural. Milkweed, baptisia, lotus, and pepper pods are a few suggested natural materials. The Indians and Mexicans frequently use small clay ornaments and feathers with the gourds. Gourds may be arranged and displayed in metal and wooden bowls, under bell glasses, on flat trays and mirrors. The gourds may be waxed with floor wax or automobile wax and polished, but it must be understood this waxing will not

prevent decay as the moisture is confined within the fruit. The hard-shelled varieties must be thoroughly dry before applying the wax if they are to be kept for any length of time.

Dish-cloth Gourd.—The dish-cloth gourd is a very interesting one. After the fruits are dry the thin outer skin is removed. This is easily and quickly accomplished by pounding the surface or rolling the fruit like a rolling pin and applying pressure at the same time. The inner spongy portion will be very dry and stiff. Soak this in water for a few minutes until soft and then cut down one side with a pair of scissors. The central core and all of the roughest portions are then easily cut away and that part which is to become the dish-cloth lies flat. It is squared and then it is ready for service. This cloth will not sour and improves with age. What more do you want?

Suggested Varieties.—To those who have never grown gourds the following varieties are suggested, the seeds of which may be easily obtained:

Bottle, large and small
Dish-cloth
Dipper or siphon
Calabash
Hercules' club
Japanese nest egg
Mock orange
Pear-shaped
Turk's turban
Warted sorts

P. A. K.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the International Institute, January 17, on "Plant Collecting in the Balkans."

Mr. Paul A. Kohl, Floriculturist to the Garden, was the speaker at the meeting of the St. Louis Horticultural Society, February 5, his subject being "Garden Experiences of 1936."

Mr. L. P. Jensen, Manager of the Garden Arboretum, talked before the members of the Garden Club of Gray Summit, February 1, on "1937 Novelties of Annuals and Perennials."

Dr. Hermann von Schrenk, Pathologist to the Garden, presented a paper at the meeting of the American Wood Preservers'

Association, at New Orleans, January 26, on "Toxicity of Oils Extracted from Old Timbers."

Dr. George T. Moore, Director of the Garden, gave the talk "Henry Shaw and His Garden," January 5, before the College Club of St. Louis, and February 1, before the Unity Club of the Church of the Unity.

Dr. J. M. Greenman, Curator of the Herbarium, attended the meetings of the American Association of the Advancement of Science, December 27-30, and was vice-president and chairman of Section G (Botanical Sciences) of the Association.

Dr. Edgar Anderson, Geneticist to the Garden, has published two papers recently: "Some General Features of the Ozark Flora" in the January *Bulletin of the Garden Club of America* (No. 1: 20-22); and, with C. M. Whelden, Jr., "Studies in the Genus Fraxinus. II," in *Journal of Heredity* (**27**: 473-474).

The outstanding winter-flowering plant at the Garden this month is *Acocanthera spectabilis* or wintersweet, in the Economic House. It is a shrub covered with dark green leathery leaves which at present are almost hidden by the masses of small star-shaped white flowers. Although it belongs to a genus of very poisonous African trees and shrubs, it is highly desirable for conservatories on account of its vigorous growth, free-blooming habit, and the fragrance of its flowers.

Dr. Edgar Anderson, Geneticist to the Garden, attended the annual meeting of the American Association for the Advancement of Science, at Atlantic City, December 27-31, 1936. On December 30 he participated in a symposium arranged by the taxonomy section of the Botanical Society of America on "Taxonomy and Cytology"; and on December 31 he spoke at the symposium of the American Society of Naturalists on "Supra-specific Variation in Nature from the Viewpoint of Botany."

Dr. Carroll W. Dodge, Mycologist to the Garden, attended the annual meetings of the American Association for the Advancement of Science, at Atlantic City, December 28, 1936-January 2, 1937. He presided at the meeting of the American Microscopical Society in the absence of the president and served on the Council of the American Association representing the Mycological Society

of America. He also represented the Academy of Science of St. Louis at the Academy Conference, and was a delegate to the National Convention of Sigma Xi.

The fourth number of Volume XXIII of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued with the following contents: "The Effect of Environment upon the Production of Sporangia and Sporangiola in *Blakeslea trispora* Thaxter," David Goldring; "New Organisms of Chromomycosis," Morris Moore and Floriano Paulo de Almeida; "New Genera of Cladochytriaceae," George Zebrowski; "Hydnangium and Related Genera," Carroll W. Dodge and Sanford M. Zeller; "Elasmomyces, Arcangeliella, and Macowanites," and "Melanogaster," Sanford M. Zeller and Carroll W. Dodge.

Recent visitors to the Garden library and herbarium were Mr. R. H. Peebles, Chief Scientific Aid, Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, U. S. Dept. of Agriculture, Sacaton, Arizona; Dr. F. P. McWhorter, Professor of Plant Pathology, Oregon Agricultural College, Corvallis, and Agent, Bureau of Plant Industry, U. S. Dept. of Agriculture; Mr. Oliver Orton, Instructor in Botany, Oklahoma Agricultural College, Stillwater; Dr. Henry Schmitz, Professor and Chief of Division of Forestry, University of Minnesota, St. Paul; Dr. D. T. MacDougal, of Carmel, California; and Dr. H. MacGinitie, Instructor in Geology, University of Colorado, Boulder.

STATISTICAL INFORMATION FOR JANUARY, 1937

GARDEN ATTENDANCE:

Total number of visitors 6,773

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought 31
Total number of books and pamphlets donated 106

PLANT ACCESSIONS:

Total number of seed packets received as gifts 27

HERBARIUM ACCESSIONS:

By Purchase—
Bracelin, Mrs. H. P.—Plants of South America, collected by Mrs. Ynez Mexia 513

Degener, Otto—Plants of Hawaii	102
University of California by T. H. Goodspeed—Plants of South America	863
Rollins, Reed C.—Plants of Washington and Idaho	400
Schimpff, Heinrich J. F.—Plants of Ecuador and Galapagos Islands	71
Williams, Louis F.—Plants of Wyoming	320
By Gift—	
Anderson, Edgar—Illustration of *Koelreuteria paniculata* Laxm.	1
Berry, Edward C.—Lichens of Iowa and Missouri	122
Drouet, Francis—*Coccomyxa dispar* Schmidle from Massachusetts	1
Dunlap, Frederick—*Populus tremuloides* Michx. from Missouri	2
Hanes, Clarence R.—*Lespedeza* and *Physalis* from Michigan	24
Kellogg, John H.—Plants of Missouri and Arkansas collected by B. F. Bush	75
Steyermark, Julian A.—Plants of Missouri	1,400
Woodson, R. E., Jr.—Miscellaneous Apocynaceae and Commelinaceae	8
By Exchange—	
Philadelphia Academy of Natural Sciences—Plants of eastern United States	676
Total	4,578

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV MARCH, 1937 No. 3

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Missouri Botanical Garden Bulletin

Vol. XXV MARCH, 1937 No. 3

GROWING WOODY PLANTS FROM SEEDS

Almost every one is familiar with the growing of annual and perennial plants from seeds, but few are aware of the fact that trees and shrubs may be propagated in a similar manner, provided a few simple rules are followed.

Seeds covered with a thick pulp, such as crab-apple, dogwood, or barberry, should be soaked in hot water until the pulp is soft. The seeds then separate easily, and should be sown at once. Seeds of many plants must be stratified, that is, subjected to the action of frost and moisture for a considerable time. This may be accomplished by sowing the seeds in the autumn, as soon as ripe, then covering the seed-bed with leaves to keep the moisture and frost in the ground. Or the seeds may be sown in shallow boxes between layers of sand, the boxes being placed where they can be subjected to the frost during the winter. Care should be taken that the boxes are protected from damage by mice and covered to retain moisture.

In the spring the seeds should be taken out of the sand and sown in beds or frames. If the seeds are very small and difficult to separate from the sand they may be sown with the sand. Shallow boxes may be used for small quantities, but a cold-frame is preferable. Select a well-drained spot for your cold-frame and be careful that your soil is in workable condition. A good sandy, black loam is ideal for the seed-bed. Make the bed 46 inches wide, and any length to suit the length of the frame. Make the sides of the frame of 1 × 12-inch lumber, and attach them to 2 × 4-inch stakes driven in the ground about every 6 or 8 feet. To support the frame nail 2 × 4-inch cross-pieces on the top at sufficient intervals.

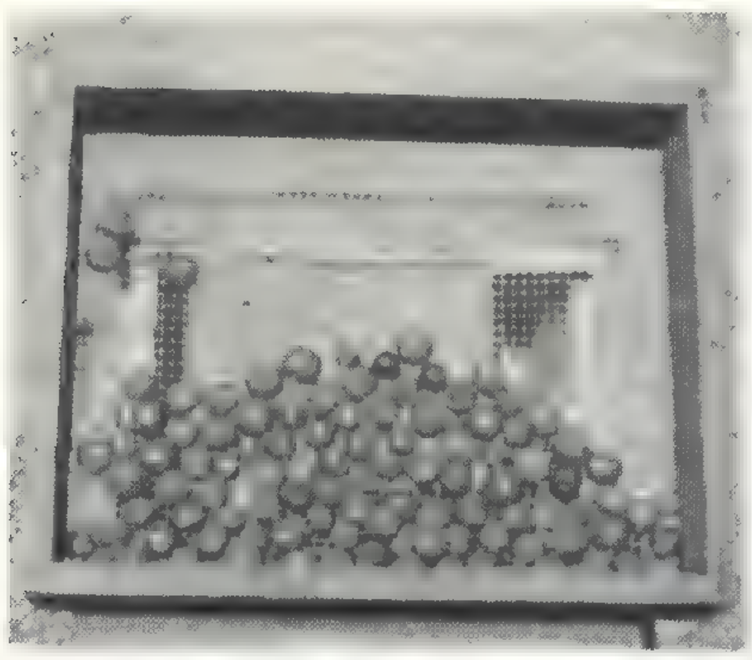
After spading the bed, work the surface very fine with a rake,

and tamp it lightly. The bed is now ready for seeding. Small seeds may be broadcast over the surface, in which case they should be carefully covered by sifting soil over them. Larger seeds may be sown in drills. Make your drills with the edge of a plaster lath cut about three inches shorter than the width of the bed, so that it can be moved forwards and backwards. After sowing, the seeds may be covered by leveling the soil lightly across the drills with the palm of the hand. The surface of the bed should then be tamped gently with a board.

Seeds should be covered about their own thickness. Large seeds, such as nuts, acorns, and Kentucky coffee-tree, germinate best when covered to a depth of two or three inches. Do not seed too thickly; seeds of conifers should not touch each other. After leveling the soil, it should be covered with sand or ground peat to prevent it baking and hardening after watering. This layer should be just deep enough to completely cover the soil. Ground peat is better than sand because it does not wash off so easily in heavy rains. After this application the surface should again be tamped lightly. The bed must then be covered with a one-inch mesh wire-screen to prevent the seed from being eaten by squirrels.

The bed is now ready for shading. Shades are easily and cheaply made from ordinary plaster laths, four feet long, nailed about an inch apart on three cross laths. With evergreens the laths should be kept on the bed permanently, but they should be removed from deciduous plants when the first leaves have developed. In hot summer weather the shades should again be put on but should be raised if they interfere with the growth of the plants.

If the plants appear too thickly they should be carefully thinned. If they are kept too moist damping-off may result. This is caused by a fungus and may be recognized by the stem becoming brown and constricted at or near the surface of the ground. Soon the plants rot and fall over. At the first sign of damping-off remove the shade to permit the soil to dry. Hot sand sifted over the plants will also check it. Keep your seed-bed free from weeds, and do not be impatient if the seeds do not germinate quickly, as many seeds such as roses, hollies, hawthorns, cedars, etc., do not germinate until the second year after seeding. Most deciduous trees and shrubs may be transplanted the year after they germi-



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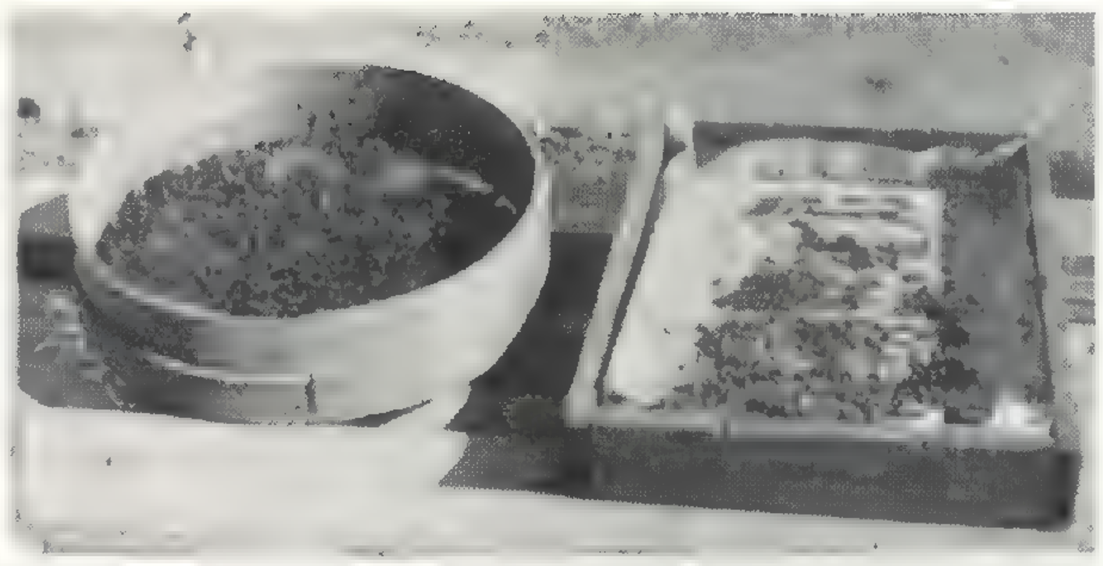

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GROWING WOODY PLANTS FROM SEEDS

1. Fruit of crab apple. 2. Seeds separated from pulp. 3. Frame ready for seeding. 4. Making drills with lath. 5. Covering seeds. 6. Applying ground peat.

1

2

3

4

GROWING WOODY PLANTS FROM SEEDS

1. Tamping soil. 2. Seed-bed covered with wire netting. 3. Bed covered with lath shade. 4. Laths raised to permit growth of plants.

nate. Conifers should remain two, or sometimes three, years in the seed-bed before being transplanted.

WOODY PLANTS WHICH MAY BE GROWN FROM SEED

Sow as early as possible in the spring:

Latin Name	Common Name
Berberis	Barberry
Catalpa	Catalpa
Clematis	Clematis
Desmodium	Tick trefoil
Deutzia	Deutzia
Diospyros	Persimmon
Fagus	Beech
Gleditsia	Honey-locust
Kerria	Kerria
Pinus	Pine
Pyrus	Pear
Rhus	Sumac
Sambucus	Elder
Sophora	Pagoda tree
Staphylea	Bladder-nut

Sow in autumn or stratify and sow in spring:

Aesculus	Buckeye
Alnus	Alder
Benzoin	Spice bush
Caragana	Pea-shrub
Carpinus	Hornbeam
Celtis	Hackberry
Chionanthus	Fringe tree
Cornus	Dogwood
Corylus	Hazelnut
Fraxinus	Ash
Ilex	Holly
Juglans	Walnut
Juniperus	Cedar
Ligustrum	Privet
Liriodendron	Tulip tree
Prunus	Plum
Rosa	Rose
Syringa	Lilac
Taxodium	Bald cypress
Tilia	Linden

Sow in late spring, when the ground is warm:

Abies	Fir
Acer	Maple
Ampelopsis	Virginia creeper
Aralia	Aralia
Betula	Birch

Latin Name	Common Name
Buxus	Boxwood
Celastrus	Bitter-sweet
Cercis	Red-bud
Chamaecyparis	False cypress
Cydonia	Quince
Elaeagnus	Oleaster
Evonymus	Wahoo
Hibiscus	Rose of Sharon
Hydrangea	Hydrangea
Larix	Larch
Magnolia	Magnolia
Morus	Mulberry
Paulownia	Paulownia
Phellodendron	Cork tree
Picea	Spruce
Pinus	Pine
Robinia	Locust
Spiraea	Spiraea
Taxus	Yew
Tsuga	Hemlock
Viburnum	Viburnum
Vitis	Grape
Wisteria	Wisteria

All berried seeds should be soaked in hot water overnight to remove the pulp. L. P. J.

SASSAFRAS LEAVES: A CULINARY POSSIBILITY

For genuine gumbo soup one must go to the Gulf States. Scarcely ever outside that area does one find the subtle aroma and the full texture which are traditionally associated with "gumbo filé." In Chicago or St. Louis or New York one may be served something *called* gumbo but to those who have eaten the real article it tastes flat and watery. One of the main reasons for this difference is filé powder, our only indigenous American condiment, a household necessity in Louisiana though practically unheard of in the North.

There is no reason why filé powder should not be used, or for that matter produced, in the northern states. It is nothing but dried powdered sassafras leaves. The sassafras is a curious tree and if English names were as formal as Chinese one might perhaps call it "the tree of the several tastes." The root is pungent, biting the tongue when freshly gathered. It is from the root bark

that "sassafras tea" is prepared and from it that the strong extract is obtained which is used to flavor gumdrops or to scent homemade soaps. The wood has a subtler fragrance. It intrigued the early American explorers, and logs of it were carried back to Europe as something exciting and precious from the New World. Supposedly it might be used like sandalwood for fragrant chests and boxes but no one seems to have done so.

The young branches have a sweeter fragrance, a sort of soapy perfume. In the leaves this latter odor is accompanied by a curious mucilaginous property which has led to their use in filé powder. This curious substance was developed by the American Indians in the days before the white conquest. Most of the eastern Indians used sassafras in one way or another, and several of the more civilized tribes dried and powdered the leaves and stored the product for future use.

Nowhere in the North, apparently, was the culinary use of sassafras taken over by the whites. Country children generally knew that the young leaves could be chewed into a curious mucilaginous paste, and an occasional pioneer may have tried them in a stew for want of something better. Only in the South were they developed as a generally recognized condiment and there only by the Creoles. These culinary geniuses fused Mediterranean and northern European and indigenous American elements into a new and distinctive cookery. They took over the use of dried powdered sassafras leaves and named the powder "filé."

At first they bought the filé from the Indians. In recent years it has been made and marketed by the negroes or manufactured in quantity and sold in small glass bottles. The product has remained the same as it was in primitive times, simply the leaves of the sassafras tree dried and powdered and put through a fine sieve, sometimes with the addition of a few wild bay leaves to increase the flavor. One elderly Creole has told me how, when she was a child, she used to be taken marketing with the family's negro mammy. The old French market in New Orleans was in those days an even more picturesque sight than it is today. Along the nearby quay sat groups of men making sails. Beyond them rose the masts and riggings of the ships. Here and there in the market were Indians with native produce: game, blowguns (soon afterwards prohibited), and filé powder. The last was brought to

market in little olive-green bags from which it was dipped with a crude saucer, each dish holding just "a picayune's worth," the picayune being the smallest coin in Spanish days.

Although universally used by the Creoles, filé powder is employed for only one purpose, to flavor and thicken gumbo soup. Genuine Creole gumbo always has either okra or filé powder as a basis for its faintly mucilaginous texture. Okra, of course, is added early in the preparation of the soup but when filé is used, it is never put in until just as the soup comes off the fire. Not a great deal is required; a few spoonsful for a large kettleful are quite enough. The filé adds a subtle something to the flavor; it gives the gumbo (or gumbo filé as the Creoles say) a smoother texture and it changes the appearance altogether. It must be confessed that while to Nordic palates Creole cookery is superb, it is often unsightly to Nordic eyes. Filé, seen for the first time, looks like something added by mistake. One might vary the old adage and say that it was a brave man who swallowed the first gumbo filé. Yet after that first time the appearance becomes associated with the excellent flavor and one learns to welcome it as an evidence of genuine Creole gumbo filé. E. A.

COMMON NATIVE TREES OF MISSOURI. II

BOX-ELDER (*ACER NEGUNDO* L.)

The least desirable of all maples as a shade tree for street or lawn is the box-elder or ash-leaved maple (*Acer Negundo* L.). When young its rapid growth and symmetrically rounded head make it a pleasant subject, but its habit of shedding leaves throughout the summer precludes its use in formal planting.

Normally the box-elder grows associated with hackberry, soft maple, elm, and ash, in the lowlands along the banks of the larger streams and if planted in a dry locality in the garden it is short-lived and its development is much retarded. Since it rarely exceeds fifty feet in height it never becomes the dominant tree. No other native maple approaches it in tolerance to shade. Usually forming part of the overgrowth in the flood-plain forest it never grows in pure stands. It is widely distributed over the eastern half of the United States, reaching its greatest development in

the Ohio and Mississippi Valleys. Farther west it has been extensively used in wind-breaks and as a street tree.

Identification of the box-elder is not difficult, since it is the only maple with compound leaves. The terminal branches are green, although there is a form with purplish branches. The flowers are borne on long filaments, and appear shortly before or with the leaves; the pistillate on one tree, the staminate on another. The

STAMINATE FLOWER

PISTILLATE FLOWER

pistillate flowers are at first seen as tiny green wings which later grow into the typical winged maple seed. The staminate flowers are more delicate, consisting of a long opaque filament the tip of which supports the red anther. The seeds mature late in summer and persist until wind and snow dislodge them. The bark is slate-gray in color at first, becoming darker, with a characteristic plaited effect, and on old specimens is thinner than that of any other native maple.

The box-elder has a number of special insect enemies. Most of

them are piercing sucking insects causing injury by withdrawing juices from the leaves and branches. One, the box-elder bug, is a strikingly marked red and black member of the squash-bug family. These insects may remain unnoticed all summer while busily extracting sap from the tree. But, when ready for hibernation in fall, great numbers congregate on the sunny side of the trunk. During dry seasons the tree is attacked by the red-spider, and in wet seasons it acts as host to the aphids. The leaves, however, are greedily eaten in any season by many kinds of caterpillars. They are the particular food of the tent-caterpillar.

DEVELOPING SEEDS OF BOX-ELDER

TRUNK OF BOX-ELDER

A. P. B.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, has been re-elected president at large of the Herb Society of America.

The University of Illinois Library School, in its annual inspection trip of libraries, visited the Garden library, March 25.

Recent visitors to the Garden include Mr. A. D. Stoesz and Mr. Ralph Kriebel of the Soil Conservation Service.

The current number of *The Herbarist* (No. 3) contains an article by Dr. Edgar Anderson, Geneticist to the Garden, on "*Angelica Archangelica,* the Great Umbellifer."

Word has been received at the Garden of the death on February 14, of Mr. B. F. Bush, the well-known student of the Missouri flora, and for many years associated with the Garden as a plant collector.

The first number of Volume XXIV of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued, with contents as follows: "A New Genus of Anacardiaceae," Fred A. Barkley; "New or Noteworthy Apocynaceae of Tropical America. V," Robert E. Woodson, Jr.; "A Monograph of the Genus Mertensia in North America," Louis O. Williams.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, has published the following papers recently: "Publications of Interest to Park Executives" and "An Appeal for Cooperation" in the February number of *Parks and Recreation;* "Interesting and Instructive Books," and "An Appeal for Cooperation" in the March number of *Garden Life.*

Mr. G. H. Pring, Superintendent of the Garden, gave the illustrated lecture "The Bellingrath Azalea and Camellia Gardens of Mobile, Alabama," before the following groups: Gray Summit Garden Club, March 1; State Highway Department School, Sedalia, Mo., March 3; St. Louis Horticultural Society, March 5; St. Louis Florist Club, March 11; St. Louis Garden Club, March 16. He spoke before the Kiwanis Club of Normandy, Mo., March 15, on "Spring Flowers."

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Garden Club of Des Moines, Iowa, February 11, on "Unusual City Gardens," and to the flower arrangement group of the Club, February 12, on "The Beauty of Botany and the Botany of Beauty"; before the zoology seminar of Washington University, February 23, on "Morphological Evidence of Gene Action in *Primula sinensis*"; before the Student's Forum at the Washington University Art School, February 24, on "Balkan Contrasts"; before the Vandeventer Place Garden Club, March 10, on "Unusual City Gardens."

Mr. George H. Pring, Superintendent of the Garden, visited the Garden Tropical Station at Balboa, Canal Zone, January 15-January 30. While there he gave the following talks: January 20, before the Natural History Society, "The Missouri Botanical Garden throughout the Year," with colored moving pictures; January 21, before the Panama Orchid Society, "The Development of the Orchid From Seed to Flower"; January 21, before the College Club, "The Pollination of the Orchid"; January 28, before the Junior College, "The Missouri Botanical Garden throughout the Year," with colored moving pictures; January 29, before the Rotary Club of Panama, "Keeping the Tropics in St. Louis."

STATISTICAL INFORMATION FOR FEBRUARY, 1937

GARDEN ATTENDANCE:

Total number of visitors	22,808

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	39
Total number of books and pamphlets donated	84

PLANT ACCESSIONS:

Total number of seed packets received as gifts	77
Total number of bulbs received as gifts	500

HERBARIUM ACCESSIONS:

By Purchase—

Hinton, George B.—Plants of Mexico	200
University of Notre Dame Herbarium—Photographs of type specimens of *Rhus*	9
Weigel, Theodor Oswald—Plants of Taiwan, Formosa, Centuries I and II, Nos. 10949-11194 inclusive	201
Yuncker, T. G.—Plants of British Honduras	750

By Gift—

Anderson, Edgar—Plants of Iowa and Wyoming	4
Barkley, Fred A.—Photographs of *Rhus*	50
Barkley, Fred A.—*Rhus trilobata* Nutt. from Mexico	1
Chandler, Albert, by John H. Kellogg—Plants of New Hampshire	5
Hubricht, Leslie—Lichens of Missouri	30
McDonald, Malcolm—*Senecio pauperculus* Michx. from Iowa	2

By Exchange—

Demaree, Delzie—Plants of Arkansas, Louisiana, Oklahoma, and Texas	442
Gilbert, F. A.—Plants of West Virginia	106
U. S. National Herbarium—Plants of Virginia	161
Total	1961

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

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THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Orchid Grower

TROPICAL STATION, BALBOA, CANAL ZONE

PAUL H. ALLEN,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV APRIL, 1937 No. 4

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1937

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ONCIDIUM POWELLII

Missouri Botanical Garden Bulletin

Vol. XXV APRIL, 1937 No. 4

NEW OR NOTEWORTHY PLANTS. XI

ONCIDIUM POWELLII

When the late Mr. C. W. Powell, the first manager of the Garden Tropical Station at Balboa, C. Z., was collecting orchids he purchased a plant bearing showy chocolate-colored flowers from a native collector. The plant was carefully raised, and after blooming the dried flowers were sent to Dr. R. Schlechter, the orchid specialist in Berlin, for determination. Accompanying them was the following notation: "sepals and petals brown trimmed with yellow, lip yellow with brown, collected in Gatun Lake, sea level, No. 58." In 1922, Schlechter, in "Orchidaceae Powellianae Panamenses," described the plant as a new species under the name *Oncidium Powellii.*

For years the late Mr. A. A. Hunter, Manager of the Garden Tropical Station, searched for this orchid on the Pacific side of the Canal Zone region. The writer had brought specimens to St. Louis from the Tropical Station in 1927, and again in 1928, both collected on the Pacific side and supposed to be *Oncidium Powellii.* However, when flowered they proved to be the small yellow-flowered *O. panamensis* which is indigenous to the Pacific region. The third attempt proved to be successful, for in 1930 a plant from the Atlantic side was brought to the Garden which, upon flowering in February, 1935, was identical with the orchid bought from the native Panama collector.

This species adapts itself readily to cultivation in St. Louis, and four plants have already been propagated from back bulbs.

The parent plant flowered again in 1936 and 1937. The largest spikes were the two produced in 1935, being 3 feet long, with 22 flowers to the spike, each spikelet bearing twin flowers 2 inches across. Like other members of the genus Oncidium, the center of the flower forms the outline of a dancing girl. In this case the

FLOWER OF ONCIDIUM POWELLII, SHOWING DANCING GIRL IN CENTER

girl wears a bright yellow skirt and brown bodice, with yellow extended sleeves. The petals of this species are chocolate-colored fused with yellow, the margins undulated and striped with mauvish yellow.

G. H. P.

PYGMY WATER-LILIES

The pygmy water-lilies are well named. Their delicate little flowers are seldom more than two inches wide yet so perfectly are they proportioned that at first sight they give the impression of something created for a toy village. Their small size and exquisite form make them an excellent subject for a small pool

PYGMY WATER-LILIES

where larger lilies would be quite out of scale. Size is not their only recommendation, however, for they are perfectly hardy and flower freely from late spring until the first heavy frost.

Only two sorts are at all commonly grown, the white and the yellow. The white is *Nymphaea tetragona,* a species native to a good part of the northern hemisphere; in Eurasia from eastern Russia to Japan and in the New World reappearing in Idaho and

Canada. The specific name refers to its form, after the size its most distinctive feature. The whole flower is very strongly four-sided and is often so mathematically regular that it looks quite artificial. The yellow pygmy water-lily, X *Nymphaea helvola,* is the result of hybridization between *Nymphaea tetragona* and the yellow water-lily, *Nymphaea mexicana.* As might be expected from such a cross the hybrid is not only yellower than *N. tetragona* but is somewhat larger and less strictly four-sided.

Both of these water-lilies have been grown for many years at the Missouri Botanical Garden, particularly in the demonstration "Backyard Gardens." They respond well to our climate and deserve to be more widely known and grown in the Middle West.

G. H. P.
E. A.

THE SOILS OF ST. LOUIS AND ST. LOUIS COUNTY

The engrossed gardener, spading a shrub border, seldom realizes that he models in a dynamic medium. This garden dirt, so seemingly simple as it is turned by the spade, is actually most complicated: a mixture of many substances, teeming with an unseen, multitudinous microscopic life. It is built into a complex whole which varies from day to day and year to year. In structure and composition it changes as the world about it changes. Crops, climates, man and his doings, all leave their mark upon it. The soils of St. Louis gardens change with the varying seasons; they reflect the fact that a great city is growing around them. Yet they are so complex and have so long a history that they carry a strong impress of much earlier times.

Long ages ago, when dust storms followed the retreating glaciers, much of the residual silt left from the melting ice was deposited by the wind along the river bluffs. In certain favored localities the soil mantle, called "loess," may cover the rock to a depth of forty feet. Finally, following a favorable change in climate—presumably an increased annual rainfall—two general types of countryside emerged: the upland prairie supporting

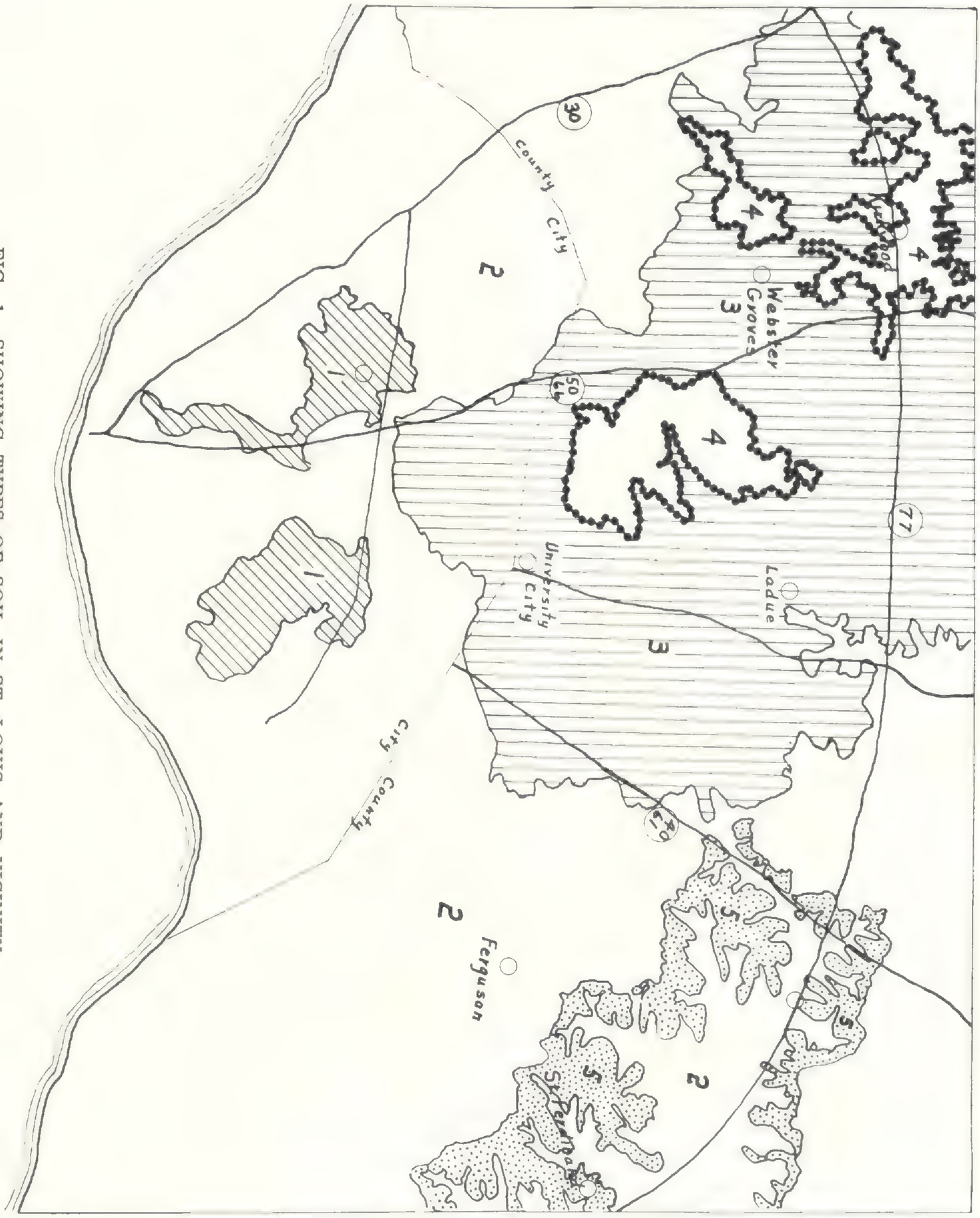

FIG. 1. SUBDIVISIONS OF ST. LOUIS COUNTY AND ADJACENT AREA.

grass and perhaps some brushy thickets around ponds and buffalo wallows; and the flood plain on which grew the only forests of the region.

These prairie soils, now planted to trees, are unique, and it is within their boundaries that the gardening communities of St. Louis are found. Stretching north from the edge of the Ozark uplift to the Missouri River, and from the Mississippi River to the west boundary of the county most tillable soil is of aeolian origin. While the loess deposit becomes thinner toward the southwest it retains its identity and varies only in the texture of the subsoil. The degree of weathering, due to the slope and exposure of individual tracts, permits a classification of the soil into several types. Some of these occur along streams and are of only local importance. These may range from fifty to a thousand acres in extent, and are often intensively cultivated as truck gardens. They may be dismissed, however, as "gardening" soils, since generally they are not found around the larger population centers. The sketch (fig. 1) shows, in a general way, the five types of soil encountered around St. Louis. The classifications do not apply in residential sections where subsoil from the basement excavation was used to make the fill about a new home. They merely indicate the type of soil in that region; not what may be expected in any particular garden.

On the accompanying map the area marked 1 includes the Garden and Tower Grove Park, and a section north of Chouteau Avenue. This soil is known as Muscatine Silt Loam. Only these two sections of about four thousand acres belong in this type. It differs from the Tama Silt Loam (marked 5) found in the Florissant Basin in the character of the subsoil. That of the Muscatine is much more plastic. This presumably was due to the level topography which favored the slow percolation of very fine clay, and thus the subsoil became heavier than most other loess loams. Hard-pan can be found about thirty inches deep.

The Tama Silt Loam (5) is essentially the same soil, except for the more open texture and better drainage of the deeper portions. Drainage has favored the rapid reduction of organic matter. In a dry season it is probably even drier than the Muscatine, but nevertheless an excellent gardening soil.

Memphis Silt Loam (2) covers the greater portion of the eastern half of the county and includes most of the truck gardening areas. It differs from the Muscatine and Tama in the very open subsoil. In many sections there is no change in texture even to considerable depths. Hard-pan occurs infrequently.

Perhaps most of the ornamental plantings grow on Clinton Silt Loam (3). This is an extensive deposit beginning in Forest Park and continuing west to Ellisville. It differs from the Memphis in the lower humus content, as shown by the generally lighter color, and represents a much more weathered phase of loess.

Marion Silt Loam (4) is centered around Kirkwood. Its general lack of productiveness is best indicated by the common name of "post oak land." It is the oldest and most weathered soil in the county and apparently the driest. There is a rolling phase south of Clayton which may have a friable subsoil. Such portions may exhibit the characteristics of a much younger soil.

The last type (not marked) is a rather narrow strip called Knox Silt Loam extending in an unbroken line along the tops of the Missouri River bluffs. This is the typical loess deposit. It is characterized by great depth and uniform texture clear to the underlying rock. There is no impervious subsoil to interfere with root penetration or water percolation.

While these soils vary considerably in depth, character of subsoil, degree of weathering, and humus content, they are all good "gardening" soils. There are no inherent deficiencies which cannot be remedied in a short time. The great water-holding capacity and the rapid percolation of rain permit early working in spring. However, those qualities which contribute so much to their excellence for general horticultural purposes seem to add to the hazards of growing plants during a succession of dry years. The roots of alfalfa and apple trees have been found to extend downward for twenty-five feet. Thus each plant has from five to ten times the volume of soil in which to develop as is available to similar plants growing on clay. The residual clays are generally shallow, rocky, and frequently underlaid with hard-pan. All root development is restricted to the zone above this impervious layer. Often less than four feet of soil is available for growth. However, it takes far less water to wet such clay

soils to the maximum root penetration than it does to furnish optimum growing conditions for trees on loess. This might explain the remarkable recovery made by plants on the more shallow clays, immediately after the first rains in September, and the almost impereeptible change on loess. Although the run-off from a clay is much greater than from loess, it may supply more moisture for a brief period as well as extract more moisture from the air during a humid night.

A. P. B.

FOLK MEDICINES

Folk medicine,[1] like other folk lore, gives a keen insight into the lives, hopes, fears, and misfortunes of "less" sophisticated people. Also it indicates the more prevalent diseases of a group. Even today there are thousands of communities where the major part of the population is more or less illiterate, so that its news, knowledge, and entertainment are generally perpetuated through word of mouth, even from generation to generation. Invariably in such a society there is allusion to medicinal and charm cures.

In the Arkansas hills corn starch and brown "floar" [flour] are used for heat. Sweetened water in which cherry bark has been soaked is considered fine for coughs. Peach-leaf tea is recommended for hair tonic and for worms. Egg membrane or prickly pear is used for draining boils. Red oak bark is used for "die," poke-root for "each" [itch], and gum turpentine is chewed for sores in the mouth, toothache, or a sore throat. Water allowed to stand in a hollow red oak (or most any hollow) stump until it is black will sure smooth the "rinkills" out of one's face. Dogwood bark is the old stand-by for chills, but a cotton yarn dipped in turpentine and tied around the waist with the knot over the navel is regarded as a sure cure for the malaria. "Black hall" [Viburnum] root is used for "wimin's ailins," black draught [Ilex] for physic tea, and sassafras tea for a "blood thinner."

In the southern states "home remedies" are varied and numerous. The bark of red oak is made into a tea or poultice for

[1] See also: Barkley, W. W. Drug plants of Mississippi. Thesis ined. University of Oklahoma. 1936.

bringing "a rising to a head," and for ground itch and other skin diseases. A tea made from the root of the "red shank" [Rumex] is used as a wash for sore mouth. The bruised green leaves of huckleberry in the form of a cold-water tea are supposed to cure pyorrhea. A boiled tea decocted from the bark of the wild plum just before blossoming time is used in asthma. Onion bulbs are good for swelling and pneumonia. For an emetic the bark of elderberry bush should be skinned upward, but to settle the stomach it must be peeled downward. Cottonseed tea with a little sulphur is used for colic. Snuff and tobacco are remedies for cuts and wasp stings. Cedar balls are used in the form of a poultice for rheumatism and bruises. Green moss from the bark of oak trees in the form of tea is used for salivation. A decoction from the small limbs of "tag" alder is supposed to purify the blood. Bark of the limbs of the persimmon tree is chewed as a cure for diarrhea. The fruit of the persimmon just before ripening is used to prevent swelling and soreness from cuts or bruises. Tea made from corn fodder will make measles break out. The seed of Jerusalem oak cooked in molasses candy is used for worms in children. The root of swamp root makes poultices for sores. Poplar bark, dried and ground, is said to give results in dropsy. Fig leaves are smoked for asthma. Two drops of blood from a "bessie bug" [bed-bug] dropped into a child's ear is the accepted cure for ear-ache. Blackberry root tea is used for diarrhea. A tea from wild cherry bark is good for coughs, as is dogwood-bark. Water in which Indian turnip rhizome has been placed is given for colic and pains, and tea from the root of green meadow for kidney trouble. An Irish potato should be carried in the pants pocket for chills, and asafoetida tied on a string around the neck is a charm against certain diseases. A pocket knife held on the back of the neck is said to stop nose bleeding. Willow bud tea is used for chills and horseradish root tea for colds. In Arkansas, peach-tree bark is employed as a poultice for risings. A tea from sheep-sorrel leaf is used for lung colds, and one from the inner bark of the hickory tree as an expectorant. Black root [Aletris] tea is used as a purgative. Ground-ivy vine tea is a remedy for hives of babies.

Indian cures are on about an equal plane with those above listed. In "*Social and religious beliefs and usages of the Chickasaw Indians,*"[1] Swanton lists many diseases of the Chickasaw Indians and the cures for them, some of which are as follows:

> *Sinti homa abeka,* "red snake disease." Symptoms: The legs, arms or other parts of the body draw up, sometimes to the extent of breaking the back. Remedy: "A vine called sarsaparilla," growing along creeks and having yellow flowers.
>
> *Iyaganaca abeka,* "little people's disease." Symptoms: The patient is out of his head, talks incoherently, and sometimes falls to the ground like an epileptic. Remedy: The root of the huckleberry *(osik'oktci).*
>
> *Kinta' abeka,* "beaver sickness." Symptoms: Dysentery. Remedy: *Acomala hakcic* (cottonwood root) and *Tanaco* (willow root) boiled together and taken internally.
>
> *Onsi' abeka,* "eagle disease." Symptoms: A severe headache which prevents the patient from exerting himself in any manner: the eyes are affected and there is a cramp in the back of the head and neck. Remedy: The ends of cedar limbs *(tcowanhala')* and the elder *(baconktci'),* warmed together in water and placed upon the patient's head.

It is interesting to note the number of drug plants used by Indians also included in the U. S. P.[2] and N. F.[3] Densmore in "*Uses of plants by the Chippewa Indians,*"[4] lists sixty-nine plants, and of these nineteen are given in the N. F. and U. S. P. VIII or U. S. P. IX. Similar studies show a similar ratio.

At Boley, Oklahoma, is an example of what seems to be a rather typical Negro herb doctor. He is a quarter-blood Chickasaw, who learned his lore from his Indian grandfather and Indian doctors at the Indian academy. He collects most of his herbs, but those not found locally (within a hundred miles) he buys. He uses black snakeroot; wild indigo (Baptisia with a cream-colored flower) for heart trouble; sassafras for the blood; flowering dogwood; silkweed; Indian hemp; prickly ash; yellow sarsaparilla (as a blood tonic); dog fennel; mandrake (collected in the spring); pennyroyal; iron-weed, as a blood regulator and

[1] Annual Report of the Bureau of American Ethnology **44**: 169–273. 1926-1927.

[2] The Pharmacopoeia of the United States of America.

[3] The National Formulary, 5th edition.

[4] Annual Report of the Bureau of American Ethnology **44**: 275–397. 1926-1927.

for urinary disorders; poke-root; sunflower (the boiled seeds for bronchial trouble); and wild cherry for cough syrup. The bark of the trunk and roots of the flowering dogwood is used as quinine. As "it is easier to compound," the bark is taken only from the north side of the trunk of the tree.

A younger, more sophisticated Negro, with degrees of D. C. and D. O., has been practicing herb doctoring in Boley since 1908. He calls himself a botanical herb doctor and dispenses his own prescriptions, using his own prescription-label (fig. 1).

FORMULA

Cascara, Dandelion, Mandrake, Polk Root, Gentian, Burdock, Licorice, Wild Cherry, Juniper Berries, Senna and other Herbs.

Directions:

Date _____No. _____Dr. _____

Botanic Medicine, Non-Alcoholic, Made of Herbs, not adulterated or misbranded with-in the meaning of the Federal Food and Drug Act of June 30th, 1906.

Fig. 1

He believes herbs are the "safest medicines" and feels that physicians "are getting nearer to his type of prescribing all the time." He uses mandrake as a laxative, button-snake root for venereal diseases, wild ginger, wild alum, cheeses, knotweed, and pennyroyal. He collects all herbs he uses in the vicinity of Boley, and showed us pennyroyal and knotweed which he had just collected. For fear that we were representatives of either the State Pharmacy Board or the State Medical Board, he would not tell us more.

W. W. Barkley,
Fred A. Barkley.

NOTES

Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk before the members of the Garden Club of Gray Summit, April 5, on "Notable Private Gardens of St. Louis and Vicinity."

Mr. A. P. Beilmann, Arboriculturist to the Garden, lectured before the Greater St. Louis Association of Gardeners, March 16, on "Tree Feeding."

Mr. Charles J. Collins, exchange student from the Royal Botanic Gardens, Kew, England, now at the New York Botanical Garden, visited the Garden recently.

Dr. Edgar Anderson, Geneticist to the Garden, has returned from a two weeks' trip to central Texas where he has been investigating hybridization in the genus Tradescantia.

The March number of the *Bulletin of the Garden Club of America* (ser. VI, No. 2:41-42) contains an article by Dr. Edgar Anderson, Geneticist to the Garden, entitled "Gardenworthy Plants of the Ozarks."

Dr. J. A. Steyermark, a graduate of the Shaw School of Botany of Washington University, and who has specialized in the flora of Missouri since graduation, has been appointed Assistant Curator of the Field Museum of Natural History, Chicago.

Dr. George T. Moore, Director of the Garden, spoke before the students of Harris Teachers College, April 6, on "The Early Days of the Garden"; and before the students in botany at Washington University, April 7, on "Botany and Business."

The annual flower sermon, provided for in the will of Henry Shaw, was given at Christ Church Cathedral, April 18, by Dr. Arthur H. Compton, of the University of Chicago. Dr. Compton will be remembered as the former head of the department of physics of Washington University, and winner of the Nobel Prize in 1927.

Miss Catherine T. Fitzsimmons, of the U. S. Veterans' Hospital, Wadsworth, Kansas, and Dr. Alice Schiff, of Los Angeles, formerly pediatrician at Köln, Germany, have been studying

fungi causing disease in man, under the direction of Dr. Carroll W. Dodge, Mycologist to the Garden.

Mr. George H. Pring, Superintendent of the Garden, spoke to the Girl Scouts, at the Girl Scout Little House, March 18, on "Identification of Native Plants"; before the publicity committee of the Kiwanis Club, April 7, on "The City Garden Contest"; at the Arbor Day planting, under the auspices of the North Side Business Men's Association, April 9, on "The Value of a Tree to the Community"; before the Young Men's Sodality of St. John the Baptist Church, April 13, on "Plant Exploration."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, is one of the collaborators in the second edition of "The Stapelieae" by Alain White and Boyd L. Sloane, published in February, 1937, the third volume containing a chapter by him on "Stapelia Culture in Temperate Climates." He also is the author of an illustrated article in the April number of *The Gardeners' Chronicle of America* (Vol. 41, No. 4) on "The Practical Culture of Succulents." His article "Free-Blooming Cacti for the Amateur," from the October, 1936, Garden BULLETIN, has been reprinted in the *Canadian Horticulture and Home Magazine*, March number (Vol. 60, No. 3).

STATISTICAL INFORMATION FOR MARCH, 1937

GARDEN ATTENDANCE:

Total number of visitors	33,592

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	24
Total number of books and pamphlets donated	69

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	302

HERBARIUM ACCESSIONS:

By Purchase—

Aellen, P.—Plants of Syria and Corsica	425
Skutch, Alexander F.—Plants of Costa Rica	215
Steyermark, Julian A.—Plants of Missouri	2,000
Photographs of type specimens	24
Sydow, H.—"Mycotheca germanica," Fasc. 57-60, nos. 2801-3000 inclusive	200

By Gift—

Anderson, Edgar—*Forestiera acuminata* (Michx.) Poir. from Horticulture	1
Barkley, Fred A.—Photographs of *Rhus*	8
Benke, H. C.—Plants of Louisiana	4
Hubricht, Leslie—Lichens of Missouri	53
Humiston, C. E.—Fungus from Illinois	1
Ownbey, M.—Photographs of type specimens	2
Seibert, R. J.—Plants of Panama	10
Steyermark, Julian A.—Plants of Oregon and California	3
Stokes, James—Plants of Georgia	3
von Schrenk, Trifon—Plants of Europe, collected by Roland La Garde	105

By Exchange—

Carnegie Museum, Pittsburgh, by E. H. Graham—Plants of the Uinta Basin, Utah	527
Cornell University, by K. M. Wiegand—Plants of the United States	815
Gray Herbarium, Harvard University—Plants of Brazil	47
Hermann, F. J.—Plants of Michigan	274
Morris Arboretum, University of Pennsylvania—Plants of Pennsylvania and New Jersey	30
State College of Washington, by Lincoln Constance—Plants of northwestern United States	110
United States National Museum—Fragments of *Rhus* sp. from Arizona	1
United States National Museum—Plants of Panama	2
University of Wisconsin by N. C. Fassett—Plants of Arkansas	2
Total	4,862

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV MAY, 1937 No. 5

SPECIAL NUMBER, GARDEN CLUB OF AMERICA, MAY 16-19

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VIEW ACROSS WOODED AREA, MISSOURI BOTANICAL GARDEN ARBORETUM

Missouri Botanical Garden Bulletin

Vol. XXV MAY, 1937 No. 5

This issue of the BULLETIN has been designed to serve as a guide for the members of the Garden Club of America who will visit the Missouri Botanical Garden on May 16-19, 1937. It will be of interest, however, not only to the regular subscribers to the BULLETIN but to all friends of the institution, since it describes various phases of the work of the Missouri Botanical Garden.

THE WILD FLOWER RESERVATION

The wild flower reservation of the Missouri Botanical Garden at the Arboretum, Gray Summit, Missouri, is a magnificent opportunity but it is at the same time a difficult and complex problem. It is magnificent in its size and in its almost ideal location. The tract set aside for the reservation comprises roughly four hundred acres along the Meramec River and includes cliffs, gravel bars, ravines, river meadows, oak-hickory ridges, and forests of sugar maple and white oak. The practical management of such a tract is a difficult problem, or rather a set of problems, botanical and horticultural. It is gardening, but gardening on such a scale and under such conditions that only natural forces can be used to advantage. Weeding, planting out, manuring, watering, mulching—all such customary operations are out of the question on a four-hundred-acre wild garden. Even if there were an army of gardeners to perform on such a scale, it would be difficult to direct their efforts. In such a wild flower reservation the goal is the production of a beautiful but natural landscape in which the hand of man is not apparent.

Gardening of this sort and in this region is a pioneer undertaking. There is no one who can tell us what should be done; methods must be worked out as we go along. When we understand natural forces well enough to work with them we create the intended effect. When we do not understand them our efforts are nullified or may even be turned against us. If a few individuals of the right species are introduced into the right place they flourish and increase, but keep in bounds. If we make a mistake, they die out altogether or become rampant and mar the picture.

On the other hand, if one follows what might seem the simplest course and merely leaves the tract alone, some of the results will be undesirable. An example may help to make this point clear. When the Missouri Botanical Garden bought the Gray Summit property the flood-plain along the river was partly in woodland pasture and partly under cultivation. It has since been allowed to run wild and the old fields have come up thickly with asters and goldenrods among which thrifty young trees are just beginning to make their appearance. A river-bottom forest grows up with amazing speed. If the river meadow were left to its own devices it would, within a decade, become a thicket of elm, ash, and box elder. Since there is already an abundant stock of these trees on other parts of the flood-plain, it is desirable that the long river meadow be kept as a meadow. It will provide a beautiful vista up and down the river valley; it will show off to advantage the forests which line its sides and it will preserve its own characteristic vegetation which would be shaded out were the trees to be allowed to develop.

How then to eliminate the seedling trees and preserve the meadow? With axe and spade it would take an army of men each spring to remove the saplings. A much cheaper method is to call in fire, ordinarily our worst enemy. Last fall a fireline was plowed around the whole meadow. This was not a waste of effort since such a protection was badly needed in any case. This spring, while the ground was still damp, the tract was burned over. By this one operation the ugly weed stalks were cleared away and the woody plants were either eliminated or severely checked. The study of the meadow, however, does not cease with the burning

over. We are particularly interested in two species which grow there. One, the giant ragweed, we wish to eradicate. The other, the stately "cup plant" *(Silphium perfoliatum)*, is worth every encouragement. In order to teach ourselves how best to obtain these ends a careful record of the burning has been made. We have charted those spots which for one reason or another were not touched by the fire. Next fall they will be compared with the burned-over areas and we shall know the effect of spring burning upon giant ragweed and cup plant. If it proves undesirable, we shall try fall burning, or winter burning, for it is known that different plants react variously to such operations. In this way we shall learn in a few years how to eliminate the worst weeds from the long river meadow and how to encourage the most beautiful herbaceous plants which grow there. We shall be able to preserve the meadow as a long strip of fresh green in the spring landscape and as a riot of gold and white and blue when the asters and goldenrods and ironweeds blossom in the fall.

On lines like these a broad study of the entire tract is being undertaken. We have already mapped the vegetation, classifying it roughly as river forest, second-growth oak-sprout, oak-hickory ridges, and so on. There are two sorts of problems. One is the proper management of each of these kinds of area. As in the case of the river meadow there are ornamental species to encourage and weedy ones to eliminate. Parts of the property were once badly overgrazed. Withdrawing them from cultivation has restored their natural flora in part; it is our problem to speed the process of restoration where we can.

The other set of problems relates to the species themselves. We need to know very precisely just what grows on the property and where it is doing well. This information is quite as desirable for the inconspicuous species as for the showier ones. Life is such a tangled web of interrelationships that each species on the property affects, either directly or indirectly, every other species which is growing there. When this basic survey is completed we shall start on our most difficult undertaking, the introduction of characteristic Ozark plants which for one reason or another are not now in the reservation. This will have to be done carefully, bring-

ing each new introduction into exactly the situation where it will make itself at home and where it will look in keeping with its surroundings.

A good beginning has been made at this multifold problem. The reservation is already an attractive area. Some of the species which flourish there were long since brought into cultivation because of their beauty. Mertensias hang their clear blue bells along the lowland woods. The madder-pink of redbud veils the sides of the steeper hills. Prairie roses make tangles of shell-pink blossom along the edges of the woods in late June; and throughout the summer trumpet-creepers flaunt their orange-red blossoms from thickets and abandoned fields, while along the river they grow liana-like, their flowers hanging down in showy clusters from the river birches and sycamores.

Many of the most beautiful species in the reservation are quite unknown in gardens. Some of them are difficult to grow under artificial conditions; others have never been tried. In early April the limestone glades are pearly white with *Leavenworthia uniflora*. This little winter annual has large flowers, almost like those of a garden stock, which spring boldly a few inches above the rosette of fern-like leaves. In midsummer these same glades are starred here and there with the blue blossoms of the "glade petunia" *(Ruellia pedunculata)*, and in October they are bright with *Rudbeckia missouriensis,* a species in many ways more ornamental than its close relative *Rudbeckia hirta,* the common "Black-eyed Susan" of summer fields and meadows. Around the edges of the glades is the chittim-wood tree, *Bumelia lanuginosa,* the most drought-resistant of our native trees. It has a curious Japanesque outline, contorted branches, short twigs, and small lustrous leaves which persist until well after Thanksgiving, forming an effective contrast with other autumnal foliage. Larkspurs and purple cone-flowers grow in profusion on certain of the glades, each of them in a variety of color. It is to be hoped that the study and care of such wild flowers as these will eventually benefit St. Louis gardens. It may well present us with a number of garden flowers which will be attuned to this difficult climate and which will flourish in middle-western gardens.

E. A.

NOTES ON THE HISTORY OF BOTANICAL ILLUSTRATION

(To accompany a selection of books from the Library of The Missouri Botanical Garden arranged to demonstrate the history of botanical illustration)

A history of botanical illustration is a history of botany itself. The study of plants has been carried on through the ages but in very different ways from age to age; the botanist of today is quite another sort of person from his predecessors of the nineteenth and eighteenth and seventeenth centuries. He works under very different conditions; his point of view has changed, and he has a different attitude towards his work. Nowhere are these changes more strikingly recorded than in the illustrations to botanical books. A visit to a large botanical library, such as that of the Missouri Botanical Garden, may well serve as a demonstration of the history of botany.

The earliest printed books devoted to plants show the study of botany as merely incidental to medicine. The first printed herbals have crude, though quaintly decorative, illustrations. They reflect the respect for tradition and authority which marked the Middle Ages. With the Renaissance there came the same sudden and glorious development of the study of plants as in all the creative work of that era. The herbals of Brunfels (1464-1534) and Fuchs (1501-1566) are illustrated with woodcuts which are not only a delight to the eye but are a stimulus to the mind. Artistic perception has been wedded to scientific accuracy. Delight in the forms of plants has been combined with the passionate desire to observe and analyze. Finicky details such as leaf margins and venation have been faithfully rendered, and the design of each woodcut is based upon the natural rhythms of the plant.

With such stimulus botany soon developed as an independent science. The immensity of the task of classifying all the plants of the world was realized at last. Botanical books became more precise and less picturesque. By the time of Linnaeus (1707-1778) the art of plant description had become so well developed that illustrations were merely incidental to the text.

corum TOMVS Secundus. 35

FRAGARIA.

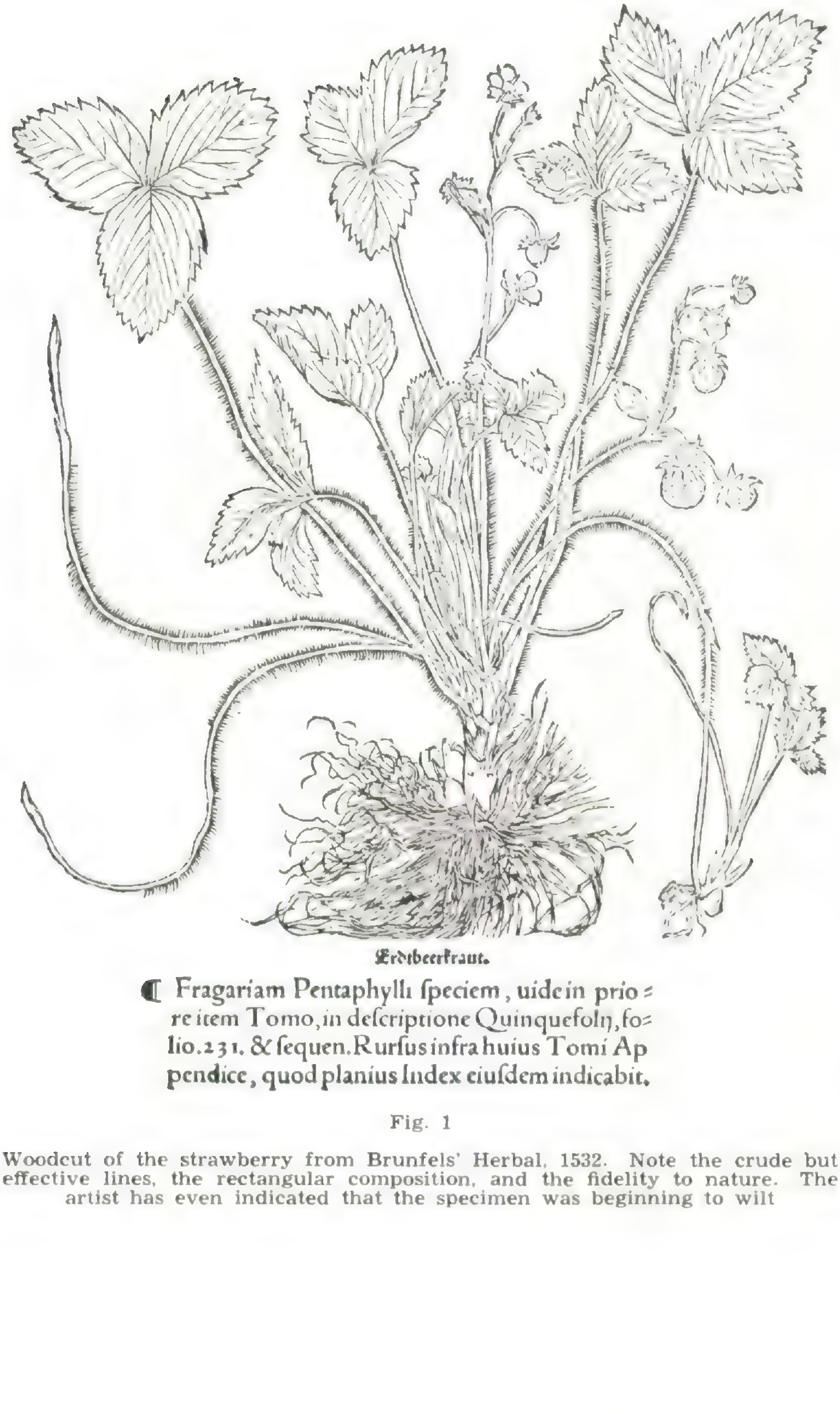

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Fig. 1

Woodcut of the strawberry from Brunfels' Herbal, 1532. Note the crude but effective lines, the rectangular composition, and the fidelity to nature. The artist has even indicated that the specimen was beginning to wilt

T XXXV

Fig. 2

Engraving of a thistle from Allionius, 1785. Though in many ways excellent it is more elegant than accurate

17. Mertensia humilis Rydb. in Bull. Torr. Bot. Club **36**: 681. 1909.

M. alpina var. *humilis* Macbr. in Contr. Gray Herb. N. S. No. 48: 20. 1916.

Stems ascending or erect, 4–20 cm. tall; basal leaves oblong-ovate to oblong-lanceolate, glabrous, subcoriaceous, 1–6 cm. long, 0.7–1.6 cm. broad, winged petiole longer or shorter than the blade; cauline leaves linear-oblong to lanceolate-oblong,

Fig. 10. *M. humilis.* Habit sketch × ⅔; enlarged flower × 1⅔.

glabrous or at most pustulate, sessile or nearly so, subcoriaceous, 1.5–6 cm. long, 0.5–1.5 cm. broad; inflorescence congested; pedicels glabrous or pustulate, 0–5 mm. long, calyx glabrous on the back, 2.5–5 mm. long, the lobes broadly to narrowly lanceolate, acute, ciliate, slightly accrescent in fruit, 2–4 mm. long, 0.75–1 mm. broad at the base; corolla-tube exceeding the calyx, glabrous within, 3–6 mm. long; corolla-limb sub-

Fig. 3

A page from a modern monograph, 1937. Note the accurate and precise bibliographical references, the technicalities of the description, and the diagrammatic enlargement of essential details

In the eighteenth and early nineteenth centuries science was one of the playthings of the elite. Scientific work was carried on mostly by gentlefolk, much of it under the patronage of royalty. Naturalists like Linnaeus and Buffon were courtiers, accustomed to the niceties of polite society. The botanical works of the time reflect this cultural atmosphere. They are nicely printed and on good paper; the illustrations are detailed, sometimes speciously so, and are tastefully arranged on the page. Like the Georgian architecture of the same period, they unite a refined sense of proportion with the learning of a scholar.

With the nineteenth century science became utilitarian, and strictly botanical works had efficient but rather ugly illustrations. The study of plants became divorced from the urge to grow them. The English gentry continued to collect rare species from all over the globe, and elegantly illustrated horticultural folios often resulted from their collections. Sometimes, as in the previous century, these collections were also made the subject of scrupulously careful scientific study. As the century wore on works of combined horticultural and botanical worth became less frequent.

The twentieth century finds the situation much the same. Botanical works with excellent and copious illustrations are still produced, particularly in central Europe, but they are in the minority. Many of those scientists who study flowers have no great love for them. Most of those who love and grow flowers lack the scientist's ability for concentrated study. A modern monograph is an efficient compendium of codified detail. Its illustrations are usually a minor feature. Most botanical workers of the present day cannot afford good illustrations; the times are now so organized that only in rare instances can art and science work together.

E. A.

THE SEEDLING ORCHID COLLECTION
(HOUSED AT THE ARBORETUM, GRAY SUMMIT)

Since 1926, when the Missouri Botanical Garden first made a serious effort to breed orchids, more than 10,000 seedlings have been successfully transferred from the incubators to the flowerpots. The commodious orchid houses at Gray Summit, Missouri,

are now full to overflowing. Other seedlings have been forwarded to the Tropical Station at Balboa, in the Canal Zone. Three entire greenhouses at Gray Summit have for three years been filled to capacity with home-raised hybrids of flowering age, another houseful reached maturity this year, and there are more to come. In 1937, of the more than 6,000 blooms on display in the mid-winter orchid show, over 75 per cent were our own seedlings.

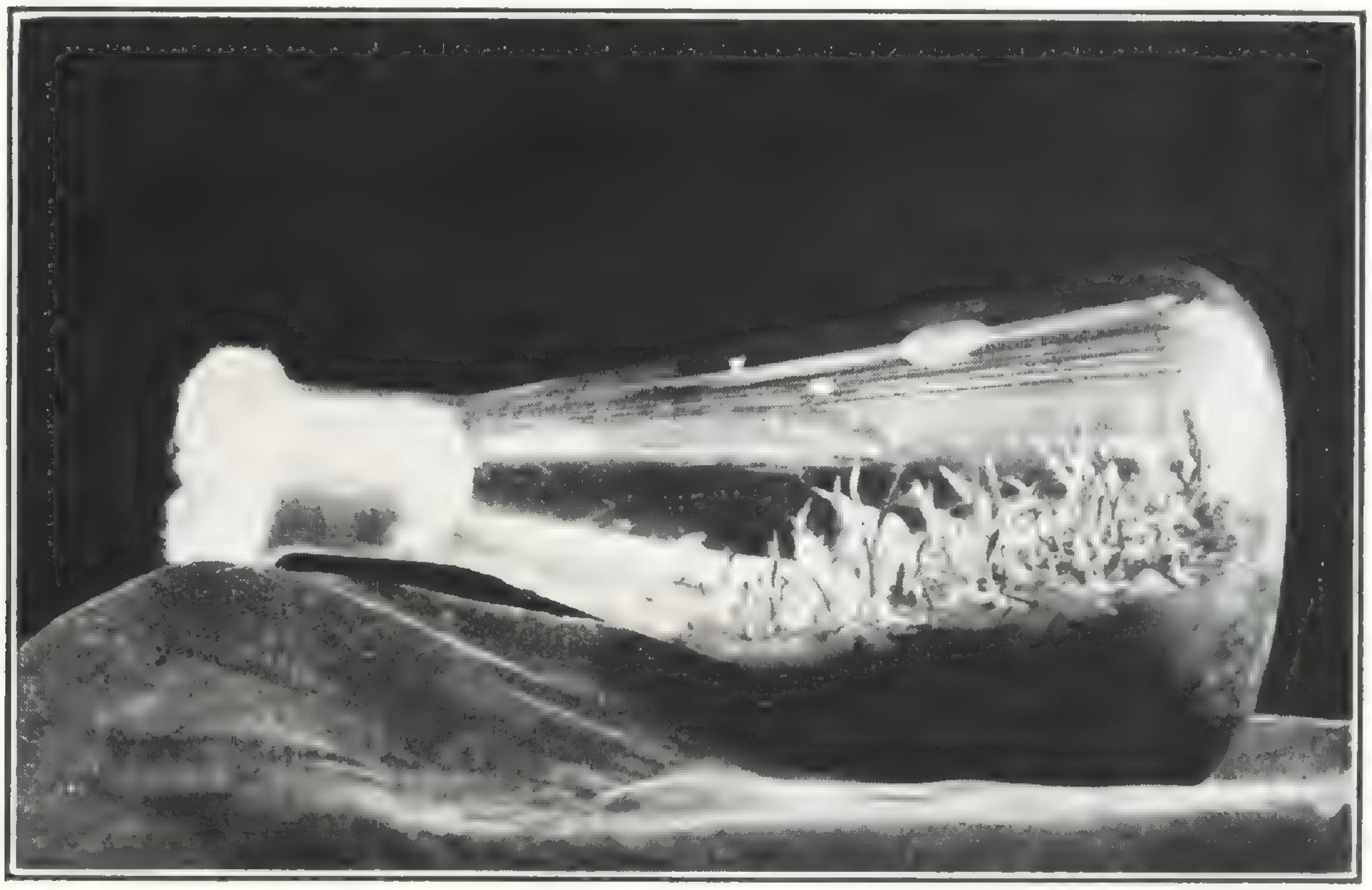
This encouraging success in raising one of the most difficult of flowers is the result of several factors. First, the actual raising of the seedlings was carried out by Eleanor Alberts Linder, whose patience and skill as an orchidologist have never been surpassed. Second, there were excellent foundation stocks among the large collections of South American orchids secured by Mr. G. H. Pring in 1923. Then, too, as soon as the seedlings were out of the incubators there were available for them the Garden's new orchid greenhouses at Gray Summit, orchid houses especially designed for this climate and incorporating a number of novel features for the control of temperature and humidity.

Even under these conditions bringing the hybrids from seeds to flower was a tedious business. After the actual crosses had been made, it was eight to ten months before the tiny, dust-like seeds were mature. They were then sown in glass incubators on a special nutrient gelatine. Here they were grown aseptically for six to ten months and then transplanted into doll-size pots—thimble pots is the technical name—to be moved gradually into larger flower pots as their growth demanded. The most precocious of the hybrids began to flower four years after germination but even these had to be grown on for at least two more years before they were sturdy plants with large perfect flowers.

Over 350 crosses were attempted, but many were abandoned at an early stage. Sometimes this was done for lack of space; sometimes because the cross did not take or because the seedlings were weak. Some forty different crosses have been brought to maturity, most of them in very large numbers since only a very few seedlings were lost from those finally selected for growing on. Cattleyas and Cattleya hybrids predominate. There are a few miscellaneous hybrids, a fine group of Cymbidiums, and a number of Dendrobiums, a successful attempt having been made in this

last genus to produce hybrid novelties with shades of mauve and primrose-yellow.

While many of the crosses have produced beautiful results, the most successful from a practical viewpoint have been the Brassocattleyas. Two such crosses, No. 15 and No. 42, have each produced about 500 seedlings now of flowering age. In size and color and shape they are superb but of even greater importance is the fact that they take kindly to hot, dry summers. Last year, when many of the tropical orchids were suffering badly from the heat



CYMBIDIUM HYBRID SEEDLINGS, 4 MONTHS OLD

and the dry air, these brassocattleyas were doing as well as in previous years. Both of these crosses had as one parent a carefully selected wild plant from the collection of South American orchids. For cross No. 15 it was a particularly fine *Cattleya Trianae,* for No. 42 it was an outstanding *Cattleya Schroederae. Brassocattleya Fournierii,* a hybrid between *Cattleya labiata* and *Brassavola Digbyana,* was used as the other parent in both of these crosses. Like all such hybrids, it combined the large size of the Cattleya and the beautifully fringed lip of the less con-

BOUQUET OF ORCHIDS PRESENTED TO THE QUEEN OF THE VEILED PROPHET BY THE GARDEN IN 1932

(Courtesy of St. Louis Post-Dispatch)

spicuous Brassavola. Crosses No. 15 and No. 42, by bringing in other unrelated species of Cattleya, have increased the size and hybrid vigor even above that of *Brassavola Digbyana*. Cross No. 15 shows the influence of *Cattleya Trianae* in that it is earlier flowering and has brighter, darker colors than the cross with *Cattleya Schroederae*, No. 42. Between them these two crosses furnish a beautiful set of large-flowered Brassocattleyas from November to March, all of them characterized by large, deeply fringed lip-petals and varying in color from pure white to deep mauve.

In addition to the seedlings there are some 10,000 orchid plants of flowering size which furnish variety and quantity for the annual orchid show. Many of these are named horticultural hybrids, others are collected wild species.

At the Tropical Station of the Garden at Balboa, Canal Zone, there are now growing between four and five thousand orchid plants, some of which cannot be successfully maintained in the St. Louis climate.

AN EXHIBIT TO SHOW THE EFFECT OF VARIOUS ENVIRONMENTAL FACTORS ON PLANT GROWTH

In addition to the regular greenhouse and outdoor attractions, the following special exhibits have been prepared for this occasion, illustrating plant behavior under various environmental conditions, together with some of the experimental work in progress at the Garden:

FLORAL DISPLAY HOUSE

1. Progressive stages in orchid culture. The complete life history of the orchid is shown from the development of the seed to the mature plant. Symbiotic and asymbiotic methods.
2. Succulents. Seedlings, grafts, and noteworthy specimens. This collection includes such novelties as "Tiger's Jaw," "Living Rock," "Old Man Cactus," "Mescal Button," "Sheep's Foot," "Rat-tail Cactus," "Little Pickles," "Pincushion," "Prickly Pear," "Barrel Cactus," "Organ Pipe," etc.
3. Progressive stages in tropical water-lily culture. Hybridization, germination, propagation, and development of mature water-lily plants. Propagation of hardy water-lilies.

4. New hybrid geraniums developed at the Garden.
5. Bubble Bouquets. A bubble bouquet is simply a bouquet of flowers entirely submerged in an inverted glass jar of water. The respiration of the flower tissues produces the bubbles on the bouquet.
6. Reversion of varigated foliage of geraniums and coleus to the original parental leaf colors.
7. Various types of garden labels used in this country and abroad.
8. Flowers preserved in sand. With proper care fine clean sand can be poured around the fresh flowers without injuring their natural shape. They remain buried three to four weeks, then the sand is poured off and the dried specimens removed. The sand particles which adhere to the flowers may be carefully brushed off. Flowers preserved by this method will retain their color and shape indefinitely if not exposed to moisture, sun, and wind.
9. New or unusual garden and house plants.
10. Preparation of fertile garden soil.
11. Physical separation of various types of soil by water to determine composition and texture.
12. Tomato plants raised in different soils—sand, gravel, and organic materials—showing the influence of texture and nutrition on plant growth.
13. Display of commercial fertilizers used to improve garden soils.
14. The growth of coleus plants as influenced by the application of various commercial fertilizers.
15. The effect of soil reaction or pH on the growth of geraniums and begonias. Aluminum sulphate was added to make the soil acid, slaked lime to make it alkaline.
16. Soil-testing kit showing method of making nitrogen, phosphorus, potassium, and lime determinations.
17. Factors influencing the germination of seed and the development of the seedlings:
    a. Temperature; b. depth of planting; c. fresh vs. old seed; d. moisture; e. sterilized vs. unsterilized soil; f. comparative germinations in soil, sand, peats, and leaf mold.
18. Contact stimulation, showing how tomato plants grow when enclosed by wire netting, the leaves being in contact with the wire.
19. Translocation of mineral elements in the plant. The close relationship of the root system to the top growth of the plant is demonstrated. The lower end of the stem is split lengthwise and one-half the root system planted in pure sand; the other half in fertile soil. Note the well-developed top growth on the side that has the roots in soil, while the other side with roots in sand has the top growth dwarfed. This indicates that the leaves and branches of a plant are supplied with mineral elements by that part of the root system immediately below them. In other words, one side of a plant may be undernourished while the other side may be well supplied, depending on the distribution of the roots and the fertility of the soil.

20. Photoperiodism. "Long day" plants may be stimulated into vigorous growth and early flowering by using electric light to supplement the short days of winter. The treated plants received twelve hours additional light from 6:00 p.m. to 6:00 a.m. for 30 days, using 100-watt lamps. The check plants were exposed to normal daylight and received no additional illumination.
21. Plant growth in air-tight containers. The containers are sealed with paraffin and shellac. Vaseline is used as a seal around the stems. Water is added when necessary through the tubes at the top of the pots and the excess drained off through the glass tubes at the bottom. Some plants do not respond well to this treatment.
22. Relation of root development to top growth. Corn plants raised in pots of different sizes show a close correlation between the root and top growth. When plants are pot-bound (root system restricted) they are dwarfed and generally flower early.
23. Growth responses in various types of plant containers. Plants can be grown in many kinds of containers other than the standard clay pot. Glazed pots, painted pots, jardinieres, tin cans, etc., may be used successfully if water is applied sparingly. The standard clay pot is porous and permits rapid evaporation, but with non-porous containers the water is retained much longer and careful watering is necessary.
24. Hormone stimulation, showing the effects of treating cuttings and the stems of tomato plants with "Hormodin" solution and "Lanum" paste.
25. Plant nutrition. Coleus and tomatoes grown in water cultures to which various plant nutrients have been added. Note the variations which occur in the root and top growths when certain nutritive elements are lacking in the cultures. Rain water collected in St. Louis during the winter is detrimental to plant growth.
26. Common errors in potting plants and transplanting seedlings.
27. Methods of watering potted plants. Osmo-water-mat and automatic paper wick (capillary action) for constant moisture.
28. Display of common garden insects and diseases. Methods of control.
29. Plant propagation by means of cuttings, rhizomes, roots, layers, viviparous leaves, division of clumps, grafting, etc.
30. Trophies won by the Missouri Botanical Garden. National recognition accorded the Garden for originations of water-lilies; development of orchids from seed to the mature plant; displays of flowering orchids; Central American orchid garden; tropical plants; nepenthes or pitcher plants.

OUTDOOR EXHIBITS

1. *Trees:*

   a. Fertilization. Effects of feeding walnut orchard, group of oaks, certain other large trees, accompanied by charts showing growth based upon increment borings.

b. Demonstration of forced feeding. The pressure gun developed at the Missouri Botanical Garden is designed to supply immediately available nourishment to the actual feeding area of the tree.

c. Lightning protection for trees.

d. Demonstration with charts showing daily temperature range, expansion and contraction, etc., of two trees now being subjected to study with the various recording instruments.

2. *Iris and Peony Garden.*
3. *Ground-cover Experiments.*
4. *Economic Garden.*
5. *Medicinal Garden.*
6. *Bent Grass.*
7. *Rose Garden.*

NOTES

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NOTES

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV JUNE, 1937 No. 6

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

GAS PLANT IGNITED

Missouri Botanical Garden Bulletin

Vol. XXV JUNE, 1937 No. 6

THE GAS-PLANT

The term "gas-plant," which is applied to one of the most permanent of perennials, frequently evokes the question—just why is it called the gas-plant? This question is answered in gardening books and magazines somewhat as follows: "*It is said* that *if* a lighted match is held to the flower stalks on a *still, sultry evening* a flame will result." Other writers will state that only the seed stalks will ignite. The fact that horticultural writers are at variance as to the proper manner to fire the gas-plant indicates that few people ever see the plant perform. In the early evening, just at dusk, there usually is very little, if any, wind and that is a good time to experiment. There is no reason for the assertion that the air must be sultry in order to ignite the plant successfully.

The slow growth of Dictamnus, as the gas-plant is botanically known, is probably the reason why it is so seldom seen in gardens. The shiny jet-black seed is about one-eighth inch in diameter. It ripens in June, and if sown in a frame in the autumn will germinate the following spring. The frame may be left unprotected during the winter, the action of the frost apparently releasing the seedlings from the seed coats. Whether the afterripening of the seed would be hastened by placing it in the refrigerator cannot be stated, as that method has not been tried. If the seed is sown in pots in March or April there will be no germination, except for a few isolated plants, until one year later. After the seedlings are up they may be left to grow in the frame for another season, or, better still, two years, before being transplanted to other rows or into the garden. This means that if you

are anxious to have some good clumps of Dictamnus within the next few years it would be better to purchase plants and save the time it would take to grow them from seed. If you buy from reliable nurseries you will receive plants that are two and three years old. If you are bargain-hunting you will get year-old seedlings, some of which you will lose, and the others will tax your patience to the limit waiting for the time to try your luck at "firing" the gas-plant.

The Venus' fly-trap is familiar to some people for the way that it closes its leaves at the slightest touch of one of the leaf hairs; the Thalia flower will mechanically pollinate your pencil point the moment you insert it into the flower and spring the trigger that releases the stamen; and no doubt many gardeners are acquainted with the behavior of the leaves of the sensitive plant when they are touched; but how many have seen flowers that will actually ignite? If you have an established clump of Dictamnus, with numerous flower stalks, you have an ideal setting for the experiment.

As far as is known, this is the first time the gas-plant has been photographed in "action." There is nothing difficult in making such a picture providing one is a gardener and a photographer at the same time. The gas-plant should be a new subject for the "candid" camera, although the illustration accompanying this article (pl. 14) was not made with a miniature instrument, but with a regular 9 × 12-centimeter focusing camera. This picture was made by setting the camera on a tripod, focusing it on the flowers by means of a flashlight or a lighted match held near, but not close, to the flower stalks, placing the film or plate in the camera, and opening the shutter. The match is struck just outside the view of the camera lens and then brought to the base of one of the flower stalks. "Puff"—the plant has provided its own light for the exposure. Close the shutter of the camera and you should have your picture.

The flower and seed stalks of Dictamnus exude an aromatic, resinous substance which may be seen in droplets along the stalks. When there are many of these there is an accumulation of this volatile substance which only needs a flame to ignite it. This feat can be performed but once on each stalk. The flame is

GAS-PLANT (DICTAMNUS)

of such brief duration that the flowers are uninjured but the setting of the seed is somewhat hindered. Dictamnus is not finished with its tricks when the stalks have been ignited. When the seed is ripe the pods gradually open and each pod, when dry, forcibly expels the seeds a few feet from the plant. Thus Nature, in this case, uses a mechanical device to distribute the seed. If the seed stalks are gathered when the seed is ripe, just before the pods open, and are placed in a paper bag, a regular bombardment will continue within the bag as long as the drying pods open and the seeds are expelled.

Dictamnus is a perennial plant free from insect pests. It grows to about 2½ feet high and equally as wide. It increases in width very slowly and may be left undisturbed for many years. There are several varieties, a white, and various shades of pink and rosy-purple, all blooming in mid-May in this vicinity. The dark green leaves of the pink varieties and the lighter green of the white variety remain in good condition all through the summer and make a good background foliage plant in the perennial border. The plant demands no unusual soil conditions and should be left undisturbed unless it is necessary to make a change in the garden. It may be transplanted in the spring as growth commences or in the fall.

P. A. K.

SANSEVIERIAS AS HOUSE PLANTS

The Sansevieria, commonly known as bowstring hemp, mother-in-law's tongue, snake plant, and leopard lily, is one of the most satisfactory of all the known decorative house plants. It is one of the few plants possessing extreme adaptability to unfavorable places, and because of the ease with which it is grown it has an appeal that is universal. While it is not remarkable for the beauty of its flowers, it is grown rather for its long, exquisitely marbled, erect, and stiff leaves. Like the aspidistra, the rubber plant, and certain palms, the sansevierias are suitable as decorative material for hotels, offices, conservatories, etc.

It is not generally known that there are over fifty different species of Sansevieria, although relatively few are in the trade and

SANSEVIERIA

1. Fiber from a leaf. 2. *S. trifasciata* in bloom. 3. Golden-striped variety, *S. trifasciata* var. *Laurentii*. 4. *S. cylindrica* var. *patula* (Ife plant) in bloom

only three or four are commonly grown in home gardens. The genus is a member of the lily family and, except for four species, is confined to the tropical regions of the African continent and the islands near its coast. These four are native to India, the island of Ceylon, Burma, and perhaps China. Like the prickly-pear cactus that has been naturalized in many parts of the world, many of the sansevierias will now be found in a semi-wild state in tropical regions, the Philippines, Hawaii, the Bahamas, the West Indies, and Central America.

According to the late Dr. N. E. Brown of Kew, the leaves of all the sansevierias contain a fiber which varies in quantity and quality with the different species. As economic plants they are now extensively grown in tropical regions, their fiber being chiefly used in rope making. Before the white man commercialized this plant, its fiber was used by the natives for bowstrings, nets, cords, and for nooses to snare animals. In order to separate the fiber from the pulpy mass of the leaf the natives would lay a single leaf on a smooth bit of board, then holding one end of it secure with their big toe, they scraped away the fleshy leaf with a thin bit of hard stick held between the two hands. The fibers were then washed and allowed to dry. Gentle reader, try this easy primitive method and see what a fine strand of durable white fiber can be obtained from a single leaf in less than five minutes (pl. 16, fig. 1). The operation will also prove interesting for the children, as they will readily visualize how a natural product can be put to good use for man. According to William Roxburgh (Flora Indica, vol. 2. 1832), forty pounds of fresh, full-grown leaves, three feet or more in length, will yield about one pound of clean dry fibers.

All the sansevierias can be grown in flower pots and given the same care as for succulent plants. They are hardy enough to endure low temperatures for short periods, but warm rooms serve them to better advantage. They will thrive in any type of soil, with either a liberal supply or scanty amount of water, and will grow equally as well in darkened corners as in sunlit parlors. However, when grown in the unnatural dry heat of the average home, they will welcome a frequent syringing and washing of the leaves to keep them looking healthy and fresh at all times. Although growers in the Far West have had trouble with what is

presumably a fungus, the plant is relatively free from insect attack or disease. For this reason and the fact that sansevierias can be so easily propagated by cuttings, it will be worth while for every city dweller to grow them in his home. It may be mentioned here that there is one contagious disease affecting these plants. This is caused neither by insect or virus, but by the "enlightened" human being who has the habit of carving initials on the leaves and disfiguring the plants in many other ways.

The writer has had the opportunity to examine and study many sansevierias in commercial greenhouses and homes within the St. Louis area, and has found that all the plants growing as *Sansevieria zeylanica* have been incorrectly labelled, and should be called *Sansevieria trifasciata.* The true *zeylanica* is practically an unknown plant in cultivation, although it was one of the first species to be described. It is said to inhabit the drier regions of Ceylon, and according to the late Dr. Brown, it is not found in cultivation anywhere outside of that tropical isle. The plant has been confused with *Sansevieria aethiopica, S. Roxburghiana, S. burmanica,* or *S. trifasciata,* all growing outside of *zeylanica's* restricted limits.

The following descriptions were made from living plants growing at the Garden:

Sansevieria trifasciata Prain (fig. 2) is a stemless plant with a creeping rootstock about one-half inch thick. Vigorous plants generally produce two to four, or even six, erect, leather-like leaves, each leaf attaining a length of three to four feet. At the broadest point, which is well above the middle, the leaves measure about three inches across. In outline, the straight, erect leaves are somewhat linear-lanceolate, and terminated by a stout, though soft, point. The lower half gradually narrows from about the middle of the leaf into a concave, channelled petiole of greatly varying length. The leaves are beautifully variegated on both sides from base to apex with alternate bands of clear whitish-green and dark spinach-green to almost blackish-green. The flowering stems are greenish, about eighteen inches or more long. The flowers are borne in loose clusters, pale greenish or greenish-white in color, and somewhat fragrant. Soon after flowering, small globular greenish berries appear, ripening into bright

orange-colored fruits. These persist for a long time on the stalks, and add much to the attractiveness of the plant. Each berry contains one large seed which germinates readily on falling to the ground. The plants present quite a different aspect in their seedling stage, and it will be one or two years after germination before they assume their adult forms.

Although *S. trifasciata* has been grown for about 175 years, winning friends in all parts of the world, its golden-striped variety is rapidly supplanting the species. *S. trifasciata* var. *Laurentii* N. E. Brown (fig. 3) is like its kin in all respects except that its foliage is striped with golden yellow, and that single distinguishing feature attracts the fancy of every plant lover. It was discovered in cultivation in one of the provinces of the Belgian Congo, about thirty-five years ago, and was introduced into European collections by Emile Laurent, for whom it is named. This variety is remarkable for the fact that it can only be reproduced by rootstock. Frequent attempts by the writer and by all other propagators have so far failed to reproduce it from leaf cuttings, even when only the yellow portion of the leaves was used. All the plants reverted to the typical form, not even a faint trace of the yellow striping remaining.

Another striking Sansevieria that grows rapidly and which deserves a place in collections is *S. cylindrica* Bojer and its variety, *patula*. In the former the leaves grow stiffly erect, are much longer, and fewer in number. In the latter the leaves variably recurve or spread from a slight but somewhat abrupt recurvature near the base, giving the plant a fan-shaped appearance. Both of these plants throw out underground runners which speedily send up new shoots in the same manner as some of the Agaves and Furcraeas. In the typical *Sansevieria cylindrica* only three or four stiffly erect leaves comprise each individual growth, in addition to the few basal sheaths. The leaves vary in length, but usually are two and one-half to five feet long, and filled with an abundance of fiber. They are cylindrical in form, as the specific name suggests, or rather slightly compressed-cylindric, thicker at the base, about three and one-half inches in circumference, gradually tapering to a hardened tip. They are marked with numerous longitudinal dark green lines, of which about three or four extend

nearly to the apex and in age (or especially during withering) become more or less depressed as slight grooves. The leaves are likewise banded transversely with dark green and pale green, especially on the younger growths, and all are faintly rough to the hand. The flowering stem is shorter than the leaves, about two and one-half feet long, and moderately dense. The creamish-white blossoms are borne in clusters, each cluster usually consisting of two to four individual flowers though sometimes as many as eleven may occur. As many as eighty or more clusters may be seen on a single stalk, totaling at least two hundred individual flowers to each stem. The tubular flowers are about one and one-half inches long and bloom irregularly, that is they open anywhere on the stalk. There are six white stamens with pale green anthers; the style is white and longer than the perianth. The plants flower during the winter season, and blossoms have been noticed as early as November 2, and as late as April 10.

In *S. cylindrica* var. *patula* N. E. Brown (fig. 4), each individual plant will usually have five leaves, although sometimes only three may appear and infrequently as many as seven. As stated previously, the leaves have a tendency to spread out in fan-formation, and this pronounced characteristic easily identifies the variety, hence the name *patula*. In the typical form, the leaves are straight and stiffly erect.

Sansevieria cylindrica has been in cultivation for about a century and in its native home (province of Loanda, in Angola, Portuguese West Africa) it is said to prefer the sunny slopes near the seacoast. The cylindrical leaves can be utilized for cuttings for they will strike root readily. The first few leaves will be thin, flattened, or more or less concave, and these will be succeeded by others, a trifle thicker and less flattened, which in about a year and a half will begin to assume the typical cylindric shape of the adult specimens. This is quite a remarkable phenomenon, and as seedlings pass through this same identical stage as the cuttings it may be safe to assume that all the cylindric-leaved sansevierias may have originated from a form with flattened leaves. L. C.

NOTES FROM THE MISSOURI BOTANICAL GARDEN TROPICAL STATION, BALBOA, CANAL ZONE

(Extracts from a letter recently received from Paul Allen, Manager of the Tropical Station)

"Dr. Clark, of the Gorgas Memorial Laboratory, had two of his assistants going to Darien. He invited me to go with the party, spend a day or two getting myself sort of oriented, and then return later for a longer and more thorough collection. Of course there is no road to Darien, the only transportation being small, ratty, tropical-looking coast steamers that pick up catch-loads of bananas along the Rio Tuyra and Chucunaque. They have to leave Panama at such an hour as to bring them into the river at high tide or they can't make it in. I went down and loaded my traps and presses aboard about 5:00 p. m., and went on back to the house and waited until 10:30 as they were not to sail until 11:00 p. m. They were anchored then a mile and a half out in the bay, and as the tide was low I had to roust out a boy with a panga to row me out. He yawned and called on 'todos los Santos' to bear witness what a crazy Gringo, wanted to be rowed out to the baru at such an hour of the night. The bay was calm, with hardly a ripple, so that the phosphorescence in the water was unusually noticeable. As he would bend to the oars, the water would boil about the blades as though dipped in liquid fire, then as they rose together for the next stroke they would run glistening chains of liquid drops of light until again breaking water. It was most enchanting to watch. We soon were aboard, and found our Captain who entertained us until after midnight with tales of the Coast, Indians and Fruitarians, from Chiriqui. We all turned in to await the morning.

"Dawn found us off the Pearl Island group with the vast bulk of Isla del Rey covering the horizon to the south. The valleys looked misty and blue between the rough peaks, probably all the more interesting by reason of the almost entire absence of any people on the Islands, and the fact that they are practically uncollected. About eleven we sighted the tiny clump of coconut palms that marks the end of the great reef which bars the entrance to the bay of San Miguel. We had only to enter to see that here was no such dry land as characterizes the rest of the Pacific side of

America Central. The entire coast is hilly and forested down to the water's edge, with no mangrove so common in other places, and no sand beaches, giving in all the appearance of a vast river valley drowned by the sea. At the mouth the Bay is of great width, probably 30 miles or more, gradually growing narrower for about 120 miles. The tide sweeps in and out of this great funnel twice daily, having a rise and fall of about 18 feet at El Real, 120 miles inland. All manner of trash and debris float about in the water, as they never reach the sea before the tide changes and it is all brought back. The river seems never to be able to make up its mind, running half the time madly backwards and then on the turn of tide running just as madly the other way. We were until 8:00 p. m. reaching the mouth of the Rio Chucunaque where we anchored, the Captain being afraid of the great trees that are swept down with the outgoing tide. Often before dark we saw huge 150-foot snags come twisting and turning down with the chocolate-brown flood.

"Along about 9:30 p. m. our host from El Real came down in a long 20-foot Colombian style piragua with an outboard motor attached. We set out in the dark in his somewhat tipsy craft, with the river saying 'Whoosh' in very decided tones as it roared out with the tide. Some one said something about 'If we drowned we drowned for Science.' Quite a noble thought, doubtless, but entirely uncomforting in a tipsy dugout on a wild river during a particularly black night. At all events we reached town safely enough, and found it the usual nondescript collection of palm-thatch shacks, with the singularly incongruous addition of electric lights strung on trees and house corners where they threw shadows on the population as they wandered about and talked and did all the other endless nothings that make up the average native's daily existence. The bulk of the population seemed to be fairly well divided between blacks and browns. A sprinkling of Indians was wandering about, mostly trading with the Chinese for salt and cloth. People told me that there would be many more of them at Yavisa, as they had a settlement across the Chucunaque on the Rio Chico of about 400 persons. The Cholos are former headhunters but were conquered by the Spanish and are harmless enough nowadays, most of them speaking some Spanish.

The Indians of the upper Rio Chucunaque and the Serrania del

Darien unto the Colombian border are Kunas, a branch of the San Blas, and are the bad customers of the place. Their country begins at the Rio Membrillo on the upper river, and it is absolutely forbidden to outsiders of any description unless by special parley with the chief of each tribe as you go in. They often come down the river in their great piraguas 40 feet long, manned by a dozen men, to trade. Ten of them came into Real the night we were there and presented a complaint to Pablo Othon about the cutting of mahogany near the mouth of the Rio Membrillo, and suggested that if he could not stop the men they most easily could. They will do it, too. However, one tribe has recently invited Dr. Clark to come in and look them over for disease, so there would be a possibility to get in in that way if no other.

"The country all about this region is overshadowed by the immense bulk of Cerro Piri. It is usually shrouded in clouds, forested to the top, and must be every bit of 7000 feet. The trees are immense in the Tuyra-Chucunaque watershed, some of the largest I have ever seen. Probably they average 175 feet. Scarcely any are species you can recognize. I believe it will turn out to be the richest province in the Republic by far. Was very fortunate in getting into several clearings where they were cutting immense trees and found a fair portion in flower or fruit. Unfortunately the Lecythis were trees of 175 feet or more and absolutely unclimbable. I had to be satisfied in fighting it out with the monkeys for the pods and seeds as they fell to the ground. The rubber is tapped a great deal and, as you say, is taken off in large gourds and cloth of their own weave dipped in the latex while still fresh. They let one coat dry and then apply another. This is also much done to cloth bags for carrying in the rainy season."

NOTES

Mr. G. H. Pring, Superintendent of the Garden, and Dr. Edgar Anderson, Geneticist, acted as judges at the annual flower show of the Associated Garden Clubs of Kirkwood, May 15.

The botany classes of the University of Missouri, accompanied by Dr. H. W. Rickett, Associate Professor of Botany, and Miss

Ilda McVeigh, Assistant, visited the Garden herbarium and library, May 22.

Dr. Edgar Anderson, Geneticist to the Garden, has a paper in *The American Naturalist* (**71**:223-235) entitled "Supra-Specific Variation in Nature and in Classification, from the View-point of Botany."

Dr. J. M. Greenman, Curator of the Herbarium, presented a paper before the biology section of the Missouri Academy of Science, April 23, on "Noteworthy Collections in the Herbarium of the Missouri Botanical Garden."

Prof. J. A. Clark, Professor of Biological Sciences, and Prof. Rogers Winters, Professor of Physical Sciences, Hannibal-LaGrange College, accompanied a group of thirty students from that college on a visit to the Garden, April 23.

Mr. L. P. Jensen, Manager of the Garden Arboretum, gave an illustrated talk before the convention of the Missouri State Federation of Garden Clubs, at Cape Girardeau, May 5, on "Roadside Planting and Improvement." He repeated the talk before the Garden Club of Gray Summit, May 10.

Dr. Edgar Anderson, Geneticist to the Garden, read a paper before the biology section of the Missouri Academy of Science, April 23, on "Hybridization Studies on the Tradescantia of Missouri." He also spoke at the luncheon of the Junior Academy of Science of the Academy of Science of St. Louis, April 24, on "Adventures with Plants"; and before the horticultural committee of the Garden Club of America, May 19, on "The Missouri Botanical Garden."

Dr. George T. Moore, Director of the Garden, has given the following talks recently: May 6, at a banquet of the Business and Professional Women's Class of the Third Baptist Church, "The Man Who Has Brought the Greatest Renown to St. Louis"; May 7, before The St. Louis Horticultural Society, "The Missouri Botanical Garden" illustrated with colored moving-pictures; May 25, before Harris Teachers College, "Henry Shaw and his Garden"; June 16, the commencement address at the Sherman School.

The Garden Club of America, which met in St. Louis May 16-19, visited the Garden May 18. In addition to the regular attractions at that time, a special exhibit to show the effect of various environmental factors on plant growth was prepared in the floral display house, and a collection of books showing the evolution of botanical illustration was arranged in the library. The Garden also collaborated with the City Art Museum by a loan of illustrated botanical works in connection with its exhibit of flower portraits, and by a display of the plants of the Missouri limestone glades arranged by Dr. Edgar Anderson.

The following talks have recently been given by Mr. George H. Pring, Superintendent of the Garden; "The Romance of the Flowers," before the Kiwanis Club of University City, April 20; "Plant Exploration in Central and South America," before the Phi Sigma Biological Society of Washington University, April 21; "Jungle Experiences in Panama," before the Kirkwood Rotary Club, May 19; "Orchid Exploration in the Andes," before Alhambra Grotto, May 27; "Henry Shaw," before the graduates of the Shaw School, June 15.

The second number of Volume XXIV of the *Annals of the Missouri Botanical Garden* was issued in April. The contents are as follows: "Observations on the Development of the Male Gametophyte in Certain Monocots," G. T. Johnson and Ruth E. Peck; "Contributions toward a Flora of Panama. I. Collections in the Provinces of Chiriqui, Coclé, and Panamá, by R. J. Seibert during the summer of 1935," Robert E. Woodson, Jr., and Russell J. Seibert; "A Preliminary List of the Lichens of Central Missouri, with Ecological Notes," Edward C. Berry; "Studies in Grindelia. III," Julian A. Steyermark; "Studies in the Anacardiaceae. I," Fred A. Barkley.

Recent visitors to the Garden include: Dr. Priscilla Avery, of the Department of Botany, University of California, Berkeley; Dr. F. L. Wynd, of the Department of Horticulture, University of Missouri; Dr. Harry J. Fuller, Associate in Botany, University of Illinois, Urbana; Dr. Norman C. Fassett, Assistant Professor of Botany, University of Wisconsin, Madison; Dr. H. W. Rickett, Associate Professor of Botany, Dr. E. E. Naylor, Assistant Pro-

fessor of Botany, Miss Ilda McVeigh, Assistant in Botany, and Mr. J. T. Middleton, Graduate Assistant, all of the University of Missouri, Columbia; Miss Esther Adams, Teacher of Biological Sciences, Moberly Junior College, Moberly, Mo.; Mr. G. E. Wooliams, of the Dominion Laboratories, Summerland, B. C., Canada; Dr. Kogo Togashi, Professor of Plant Pathology, Hokkaido Imperial University, Sapporo, Japan; Dr. Alexander Hollaender, of the Department of Botany, University of Wisconsin, Madison.

STATISTICAL INFORMATION FOR APRIL AND MAY, 1937

GARDEN ATTENDANCE:

Total number of visitors in April	21,092
Total number of visitors in May	52,738

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in April	47
Total number of books and pamphlets donated in April	309
Total number of books and pamphlets bought in May	19
Total number of books and pamphlets donated in May	49

PLANT ACCESSIONS:

Total number of plants and seed packets received in April	860
Total number of plants and seed packets received in May	847

HERBARIUM ACCESSIONS:

APRIL

By Purchase—

Erichsen, C. F. E.—Lichens of Germany, Nos. 501-600 inclusive	100
Eyerdam, Walter J.—Mosses of the Aleutian and Kodiak Islands	100
Goodman, George J.—Plants of Oklahoma and Texas	350
Gressitt, J. Linsley—Plants of southeastern China	488
Thompson, J. William—Plants of Washington and Oregon	1,200
Weigel, Th. Oswald—Plants of Mexico, collected by Jesus Gonzalez Ortega	103
Wheeler, Louis C.—Plants of California	300

By Gift—

Anderson, Edgar—Plants of Texas	13
Barkley, Fred A.—Photograph of *Ailanthus*	1
Goodman, George J.—Plants of Oklahoma	6
Hubricht, Leslie—Lichens of Missouri	13
Moldenke, Harold N.—Photographs of types and authentic specimens of Verbenaceae	24
Ownbey, Marion—Plants of Wyoming	130
Seibert, R. J.—Plants of Louisiana and Panama	14

Steyermark, Julian A.—Herbarium specimens of cultivated plants of *Grindelia* 186
von Schrenk, Hermann—Plants of Missouri and Australia.... 5
Woodson, R. E.—*Mandevilla grata* Woods. from horticulture 1

By Exchange—
Narodni Museum, Prague—Fungi of Czechoslovakia..... 51
State University of Iowa, Department of Botany—Fungi of Panama and Colombia 45
Thompson, J. William—Plants of Washington and Oregon.. 88
U. S. National Museum—Plants of South America..... 64
University of Pennsylvania, Department of Botany, by John M. Fogg—Plants of Salem County, New Jersey..... 180
University of Tennessee—Plants of Tennessee..... 15

Total..... 3,477

MAY

By Gift—
Albrecht, Grace Ethel—*Prunus cericifera* Ehrh. var. *Pissartii* Bailey—Horticulture 1
Anderson, E.—*Corallorrhiza Wisteriana* Conrad—Texas 1
Barkley, Fred A.—Photographs of Rhus..... 6
Deal, Mrs. Vane—*Polytrichum* sp.—Missouri..... 1
Kellogg, John H.—Plants of Missouri..... 5
Kurz, F. A.—*Polygonatum*—Florida..... 1
Larson, J. P.—Plants of Horticulture..... 6
Lodewyks, Maude C.—Plants of Missouri..... 2
Steyermark, Julian A.—*Senecio aureus* L. var. *semicordatus* (Mack. & Bush) Greenman—Missouri..... 1
University of Florida Agricultural Experiment Station by H. H. Hume—Plants of Florida and from Horticulture 18
Von Schrenk, H.—Plants of Texas and Missouri..... 6

By Exchange—
Botanical Garden, University of Jagellonica—Plants of Poland 200
New York Botanical Garden—Plants of Mexico..... 91
State University of Iowa, by G. W. Martin—Plants of Colombia 19

Total..... 358

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV SEPTEMBER, 1937 No. 7

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

STRIKING SIMILARITY BETWEEN THREE UNRELATED PLANTS

Lower left: *Vanda teres*, an orchid; upper center: *Rhipsalis teres*, a cactus; right: *Euphorbia tirucalli*, a spurge.

Missouri Botanical Garden Bulletin

Vol. XXV SEPTEMBER, 1937 No. 7

PLANTS SO ALIKE, YET VASTLY DIFFERENT

Did you ever hear of a case of mistaken identity? No doubt you have and there are any number on record, simply because the similarity between certain individuals is sometimes so pronounced that it is quite difficult to distinguish them, especially at some distance. How many times have you slapped a fellow on the back, thinking him a friend, and when the victim turned around, he proved to be a total stranger? How many times have you innocently waved at a girl who for all the world looked like a dear old acquaintance and then found that she was no one you ever knew? These very embarrassing moments have occurred to most of us, perhaps in identical or similar cases.

In the simple account about to be related the writer wishes to draw the reader's attention to the many striking likenesses that occur among various plants, although wholly unrelated. The plant world contains an infinite number of forms, yet a goodly portion look so much alike that a non-botanical student would never guess that they belong to totally different natural orders.

In South Africa, there is found a group of tiny plants which so closely resemble the pebbles and stones among which they grow that it is almost impossible to spot them when not in flower, and often diligent collectors have spent many hours hunting for these curiosities in places where they were known to be. These living-stones and pebble plants, the mesembryanthemums, have adopted the forms of their surroundings in order to hide themselves from the browsing animals and other natural enemies of their domain.

In the cactus family there are several members that look unlike

the typical and familiar forms. In fact, some of them, particularly the Pereskias and Pereskiopsis, so closely resemble certain woody dicotyledonous trees and shrubs that even a seasoned botanist might become perplexed if the flowers and fruits were missing. Just for example, one early botanist of the late seventeenth century classified one cactus species as a spiny, broad-leaved Portulaca, while another made the mistake of describing it as an apple of the genus Malus. There are about twenty species in the genus Pereskia, most of which assume tree-like or bush-like proportions, although a few are clambering vines, and all are considered to be the most primitive types of the cactus household. They are the only true cacti with permanent foliage, all the remaining genera (with the possible exception of Pereskiopsis and Quiabentia) either possessing tiny leaves which are mostly early deciduous, or the stems taking over the function of the leaf.

Other true cactus plants which do not resemble any of the cacti of our popular conception are those included in the Rhipsalis sub-tribe. For the most part, these are epiphytic in habit, usually with slender terete stems and branches. They are generally found growing in the forks of branches of some of the gigantic forest trees of tropical America or in the little rents and fissures so common in the bark of old trees. When Britton and Rose published their monumental monograph on the Cactaceae, they placed this particular group at the end because to them it represented the most extreme differentiation within the cactus family. And to be sure it is indeed difficult to explain to most people that the members of the sub-tribe Rhipsalis are really cacti.

Another cactus which stands quite alone among the Cactaceae and one that is very interesting from a botanical standpoint is *Leuchtenbergia principis*. It could easily be mistaken for a small century-plant, so closely does it simulate an Agave of the "Victoriae-Reginae" type. The long tubercles (which some would call leaves) are arranged spirally or in an irregular fashion and at length fall off, leaving the stems scarred very much like those of certain cycads after the leaves have dropped.

Just as many cacti more closely resemble other plants than they do members of their own family, so too this phenomenon will be noticed in other plant groups. For instance, in the Euphorbiaceae,

or spurge family, there are several members that could easily be mistaken for species of cactus. And there is an Euphorbia species that startlingly mimics a Stapelia of the Asclepiadaceae or milkweed family. Then, too, a few of the succulent composites (daisy family) are so unlike their kin that *Othonna crassifolia* could easily be taken for a mesembryanthemum, *Kleinia stapeliaeformis* for a stapelia, and *Notonia pendula* for a cactus or euphorbia. There are innumerable other instances where plants wholly unrelated bear such similar likenesses to each other that only a keen observer would be able to know them apart.

The accompanying photograph (pl. 17) shows the striking resemblance in form between an orchid, a cactus, and a euphorbia, yet if the flowers and fruits could be shown it would be quite easy to classify them into their respective families. These characters are the features by which botanists are able to distinguish plant families, and no matter how alike some plants may appear, by their fruits you shall know them. In the left-hand corner is shown *Vanda teres,* a very beautiful orchid (when in flower) which grows on trees in Burma. In the upper center is pictured the epiphytic *Rhipsalis teres,* a much-branched cactus from the Brazilian jungle, while in the right-hand corner is *Euphorbia tirucalli,* a spurge claiming the Poinsettia as its relative and the East Indies as its home. The terete, dark green, climbing stems of the Vanda, together with its few scattered leaves identical in shape and color, bear such a striking resemblance to the cylindrical young branches of *Euphorbia tirucalli* that the average person would find trouble in placing the plants in their right families. The branching habit of the Rhipsalis is quite similar to that of the Euphorbia and the plants found growing under the shade of the fish-poison tree *(E. tirucalli)* in the Cactus House are often thought to be young sprouts of the overhanging spurge that assumes tree-like proportions. In color *Rhipsalis teres* is always light yellowish-green, while both *Vanda teres* and *Euphorbia tirucalli* are dark green.

The plant detective, on closer scrutiny, will find numerous little clues by which he will be able to segregate the plants. The particular orchid in question produces thickened aerial roots from its stems; the Rhipsalis may produce aerial roots irregularly; but

the Euphorbia never grows these appendages. The last is also easily distinguished from the others by its milky juice which is poisonous. The orchid grows from the branches of trees, so does the Rhipsalis, but the spurge is a terrestrial plant and of course assumes gigantic proportions in comparison with the two epiphytes. Likewise, the spurge possesses the least showy blossoms of the three plants, being very small and inconspicuous, as is the case with all the Euphorbiae. The orchid produces the largest and most beautiful flowers of moth-like appearance, hence the Vandas are popularly known as moth-orchids.

There is still another plant which could easily be mistaken for *Vanda teres* were it not for its milky stems, and that is *Sarcostemma viminale*, a trailing, twining, bush-like milkweed native to tropical Africa. The method of growth, branching, and stem coloration is so identical in these two plants that even a seasoned observer will be perplexed about their generic distinctness.

Innumerable other plants bear striking likenesses to each other and it would take many pages to record them all. The writer has picked out but a few baffling cases that exist in the collection of the Garden.

L. C.

NOTES FROM THE MISSOURI BOTANICAL GARDEN TROPICAL STATION, BALBOA, CANAL ZONE

(Extracts from a letter received from Paul Allen, Manager of the Tropical Station)

Tropical Station,
July 20, 1937.

". . . We got down to the dock in the afternoon with all the trees, vascula, presses, and other impedimenta, and got roundly laughed at for our pains by all the deck loafers. As usual, the boat came in to load at high tide, and then pulled out about a mile into the Bay to await sailing time at 11:00 p. m. At eleven the tide was out, so we had to wander stumbling and swearing along the long reef which runs a half mile into Panama Bay. After a half hour's wait, our boatman from the ship finally came bumping

along the reef with a little *panga* and took us off. One never becomes entirely accustomed to the many manifestations of the phosphorescense in the water. As the boatman would walk over the black volcanic rock, his wet feet would leave, for a fleeting instant, fiery footprints in his wake. It was really quite startling.

"Our ship was the largest owned by the company, and while the passenger accommodations were extremely poor, it was equipped to the fullest for the carriage of bananas. Morning found us near the mouth of the Gulf, with the Pearl Islands far off to southward. The sea was very calm, and as we came under the influence of the fresh water from the river dozens of porpoise appeared and lazily began going through their unending morning calisthenics of rolling over imaginary barrels. The breeze was still fresh from the coast, and it was still clear enough for us to see the high, rough-shouldered peaks guarding the entrance. By some strange alchemy of their own, they soon were brewing clouds which hung in long trailing curtains, evaporating off into nothingness. The reef at the mouth was booming, with long curling breakers going over it constantly, so we ran south and made the entrance near the mouth of the Rio Sambu. The peak there is a high truncated pyramid, and looks bare in the upper half.

"The fair weather was not to last, however, as a white mist was soon seen driving toward us down the Bay, and we were into it soon, to enjoy all the fury of a true tropical downpour. The ship rolled steadily on, and we hung over the sides to enjoy the edifying sight of the swirling mud and trash brought down by the river.

"We arrived in El Real late in the afternoon, having made a near-record run of seventeen hours. Pablo was pleased beyond words with the trees, and insisted that I wait until the next day and go up the river in the Banana Company's launch. He is their agent there in Real. He also gave me a note to the manager of the company's *finca* in Yape, so that I might stay there if I wished. The ship was busy receiving bananas until far into the night. After the men were paid off, they repaired at once to the local Chinese, and were soon enjoying themselves. Interest was divided between two local dances, with the long rubbling roll of the little log and bear-hide drums, and a sort of local variety of bowling. This latter is played by the Cholos with six squared

and roughly tapered mahogany 'pins' about eighteen inches high, and a rolling-pin sort of log also about eighteen inches. The pegs are hammered into the ground, and the player stands at about forty feet distance and throws the log at the pins. The game is to bet on whether odds or evens will be left standing. As the night wore on and the mozos got more and more excited and the betting wilder and wilder, we decided to go home.

"After many delays and false starts we got loaded into the launch and on our way in the morning. As usual, the gas in the fuel tank had mysteriously acquired a very appreciable percentage of water, which called forth voluble Spanish of the choicest from the mechanic. We finally swung into the current and headed upstream. The Rio Tuyra is extremely winding with deep alluvial soil banks. The forest has been cleared away in semicircular slices along the banks and long green stretches of bananas planted. In the center of each patch, on the river bank, are the characteristic round thatch houses of the Cholos. These are mounted on hard palm poles, with the living platform about seven feet above the ground. A notched log is the communicating unit from the ground to the living quarters above. The houses have no sides and no interior division, all living in a common communal room or platform. The floors are made of a species of Astrocaryum (?), a flinty-hard black palm. The trunks are felled and very ingeniously cracked with the ax so that they can be unrolled and flattened into a very hard and durable board.

"The Cholos paint their bodies a great deal, in varying colors, but most commonly red, black, and blue. A favorite method is to blacken the arms and hands from the elbow down, or to paint a broad blue band around the mouth from nose to chin, narrowing back toward the ears. Sometimes the patterns are very intricate and are supposed to have some tribal significance for a special occasion. The dugouts, or '*piraguas*' as they call them there, are all built Colombian style, long and slender with perfectly proportioned flattened ends, the last word in jungle river-travel equipment. We saw many of them poling upstream, using the picturesque and rhythmic method of the country. The poler mounts the flat end of the bow, plants his pole firmly in the mud, and proceeds to walk back down his *piragua* to the center, thus driving the craft upstream with his feet.

"Soon after noon the river began rising very rapidly, bringing down loads of mud, trash, and tree trunks. The crew decided it was inadvisable to try to get as far as Boca de Cupe, and turned in about 2:30 at the Cholo village of Yape. Yape is about twenty-seven miles up the river, and about twenty-four miles from the Colombian line. It is a town of perhaps twenty houses, distributed on both sides of the river. Curiously, there are no Chinese in Yape, the local trading being done by the chief of the tribe. Fortunately, I had my letter of introduction to the manager of the company banana *finca,* a Colombian, so went back with my baggage and turned in. The accommodations were a bit sketchy, being a shed open at the sides and level with the ground, but the roof was tin and there was a half-barrel to catch rain water.

"I became at once an object of extreme interest to the Colombian and Cholo workers from the compound. They would stand around in a line about the shack and watch every move I made, whispering among themselves and breaking into gales of laughter at the 'mad Gringo' and his equipment. Two of the boldest would come at meal times and sit on the opposite ends of the table while I ate, and seemed to get infinite amusement from everything. The Cholos have a monosyllabic language which they use entirely among themselves, the Colombians speaking an almost unrecognizable dialect of Spanish. I finally found a boy whom I could understand fairly well, and started out collecting plants the next morning, the river still being on a rampage. The trails we found very dark, and full of shank-deep standing water. Small scarlet fiddler crabs about the size of a child's hand would back into the entrances to their castles under the roots of trees and wave their giant claws in defiance before scuttling out of sight. The heat was intense, even more than the nearer approach to the equator would seem to warrant. Also the mosquitoes would give us no peace, dancing in swarms around us as we walked and settling on every exposed bit of skin as soon as we stood still. It soon became necessary to have sleeves down, collars up, handkerchiefs up to the eyes, and the face and neck covered below the hat.

"The first day out we saw the first leper I had ever seen. He came along in almost knee-deep water and mud, and was almost

1

2

3

1. The city of El Real, the capitol of the province.
2. Typical home and typical river men.
3. Hulling out rice.

1

2

3

1. My mozo and some of the *piraguas*.
2. Medicine man and sick boy.
3. The best bud of the Aristolochia (you have to follow the tail carefully to see it all).

on us before I noticed that his face was almost entirely gone on the left side. I shied off the trail till he had passed, and asked the boy about him. He said that he came from the higher country down to trade, and that they were occasionally seen there. The third day we came on another leper washing gold all alone in a small tributary of the Rio Balsas. They aren't particularly pleasant things to run into, especially before dinner. Collecting was about the usual run of trees, shrubs, and vines, until to my astonishment we came on the most enormous Aristolochia I have ever seen or dreamed of. This in all sober fact has flowers measuring seven feet eight inches from the top of the flower to the tip of the tail. I did my best to get pictures, as I knew no one would ever believe it in any other way [pl. 19, fig. 3]. I pressed up the two flowers we found.

"We ran into some sort of herb which causes intense burning in the legs, evidently from contact. After undressing at night and getting into my mosquito bar, the burning would still be so severe that it was almost unbearable to have anything touch the legs. This would wear off toward morning, but we would get it again the next day.

"The second night of my stay, about seven o'clock, there came the long rumble of drums from across the river and the peculiar high-pitched wail of women chanting. I went across out of curiosity and found a medicine dance in progress. They have great faith in the local medicine men, who work healing by means of charms and dances. The patient in this case was a small boy of perhaps eight years, who was twitching and moaning under a sort of canopy built by the healer. The old men and women were squatted in corners on the platform, sending out the long rumbling roll from the little drums with the slap of the fingers and final thump with the heel of the hand. The more able-bodied women were in a circle about the sufferer, each holding to the skirt of the one forward, and moving with a rhythmic stamp and shuffle around and around. The old ones would lead the chant, and the circle would come in on the choruses. After some time of this the men also formed a circle, each with a curious sort of wooden flute or horn pointing down toward the patient. Each performer seemed to need all his breath to blow one note from his instrument, at the

same instant shifting to the right with the circle. No two horns had the same pitch, and the effect was weird in the extreme, with the throbbing accompaniment of the drums. Every one was partaking freely of the *chicha,* a sort of fermented drink made by chewing corn, then spitting the entire mess into a jar to ferment. The mosquitoes were getting bad, and the proffers of *chicha* more and more often, so I made for camp. Curiously enough, the sick boy seemed much better the next day.

"Disease seems to be very prevalent in all sorts and forms. My host at the *finca* was suffering from beri-beri, so that he could press the flesh in on any part of his body, the mark being clearly visible for over a minute. We saw several others when we were on the trail. Skin disease and cancer, tuberculosis, syphilis, and fever about make the list of things commonly seen. There are no doctors, so that they must trust to the tender mercies of the medicine men.

"The usual program was to get into the nets by dark, in self-defense against the mosquitoes, and lie and listen to the bats whirring through the house in pursuit of night-flying insects. Often there would come a noise of some animal running through the shed, or the sound of the wild pigs, afar off, quarreling over the fallen bananas. Late in the night the rain would come, first in scattering drops on the banana leaves, then rapidly increasing to a roar on the tin roof, assuring me of plenty of fresh water for the morrow.

"After three days of collecting, all presses were full to overflowing, and as I had no means of drying plants it became essential to make for home as quickly as possible. After some haggling I found a boy to take me and my cargo down the river in a *piragua.* We left at daylight and swept down the bends of the river, the giant white-trunked trees rising high and majestic back of the bananas at each turn of the stream. Arrival in Real showed the river clear of any prospect of getting home, the next boat being due three days off. Fortunately, it developed that a boat was in the Rio Chucunaque loading, and due to sail at daylight. The only chance was to get out at 5:00 a. m. and run down to the mouth of the river in a *piragua* and chance catching a passage. The next morning at this hour it was raining torrents and so black you

couldn't see your hand in front of your face. I finally rousted out a Kuna boy who was in town and an old Colombian negro. We bailed out a dugout, loaded our plants and baggage, and headed down river. The rain stopped about the time we reached the mouth of the river, and we sat twixt hope and despair until 8:30. Then came a comical little tub, chug-chugging down the river. This noble craft was about twenty-five feet long, part motor and part sail, loaded with mahogany planks, plantains, a crew of four, the captain, three Colombian passengers, and two Cholo families. The tub had about a foot of free board, but after some speculation the captain agreed to take me. Since there was no other room, I spent the day and night on top, in the shadow of the sail.

"The Chinese have an old proverb, 'One picture is worth 10,000 words.' I got some fairly good pictures."

A WHITE BLAZING STAR

There has recently been discovered near Stanton, Missouri, a large colony of the Blazing Star *(Liatris pycnostachya)*, in which a number of individuals bear flowers of pure white instead of the bright rose-pink which characterizes this species. Since the genus is an unusually interesting one from a number of standpoints it seems best to give this variant a distinctive scientific name:

Liatris pycnostachya Michx. forma **Hubrichti** E. Anderson, f. nov.

A typo recedit floribus albis.

One mile northeast of Stanton, Franklin Co., Mo., July 24, 1937, *Leslie Hubricht* (Mo. Bot. Gard. Herb., **type**). E. A.

NOTES

The customary wreath of magnolia leaves and orchids was placed on Henry Shaw's tomb, August 25, the anniversary of his death.

Mr. G. H. Pring, Superintendent of the Garden, was one of the judges in the city-garden contest sponsored by the St. Louis Horticultural Society.

The article "The Gas-plant" from the Garden Bulletin (June, 1937,) has been reprinted recently in both *Horticulture* and *Wisconsin Horticulture*.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, is the author of an illustrated article "Arizona Reminiscences" in the July number of *Desert Plant Life*.

The July number of *Botanical Review* (Vol. 3, No. 7) contains a paper by Dr. Edgar Anderson, Geneticist to the Garden, on "Cytology in Its Relation to Taxonomy."

Mr. L. P. Jensen, Manager of the Garden Arboretum, has been appointed chairman of the Committee of Roadside Development of the Missouri State Federation of Garden Clubs.

Mr. G. H. Pring, Superintendent of the Garden, has given the following talks during the summer: "Henry Shaw," at the commencement exercises of the Shaw School, June 15; "Experiments with Hormodin," before the Missouri State Florists' convention, at the Hotel Chase, June 30, and before the St. Louis Horticultural Society, July 2.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated lecture on "The Practical Culture of Succulent Plants" before the Dolly Madison Garden Club at Woodberry Forest, Virginia, July 21. He also visited the United State Botanic Garden at Washington, D. C., inspecting their succulent collection.

Dr. Edgar Anderson, Geneticist to the Garden, has given the lecture, "The American Climate and the American Garden," before the North Shore Garden Club, Glencoe, Ill., June 22; before the Lake Forest Garden Club, Lake Forest, Ill., June 25; before the Lake Minnetonka Garden Club, Wayzata, Minn., July 15; and the Schoolcraft Garden Club, Schoolcraft, Mich., June 26.

The green, snake-like stems of several night-blooming Cerei, crawling upon tall trellises in the Cactus House, produced a profusion of flowers this summer, one Mexican species bearing over fifty large fragrant blossoms, twenty of which opened during one night. The last of the nocturnal bloomers (*Epiphyllum oxypet-*

alum and *Hylocereus undatus)* are finishing their season this month.

Mr. L. P. Jensen, Manager of the Garden Arboretum, attended the meeting of the Board of Directors of the Missouri State Federation of Garden Clubs, at Lake Ozark, Mo., July 29; and on August 4, the garden party of the Sedalia Garden Club, at the Missouri Highway Exhibit, Missouri State Fair, where he gave a short talk on "Roadside Rest-a-way Grounds and Roadside Planting."

Dr. Edgar Anderson, Geneticist to the Garden, is offering for the first time, a Thursday evening course on "Garden Materials and Their Identification," at University College, Washington University. Lectures and demonstrations will provide a simple, non-technical introduction to the classification and identification of flowering plants, with particular reference to those used in gardens.

Recent visitors to the Garden include Mr. F. R. Fosberg, formerly of the University of Hawaii, recently appointed Fellow at the Morris Arboretum, University of Pennsylvania, Philadelphia; Mr. D. S. Correll, of the botany department, Duke University, Durham, N. C.; Dr. Walter Robyns, Director of the Jardin Botanique de l'Etat, Brussels, and Professor at the University of Louvain, Belgium; Dr. C. L. Hitchcock, Assistant Professor of Botany, University of Washington, Seattle; Dr. George J. Goodman, Assistant Professor of Botany, Iowa State College, Ames; Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois, Urbana; Dr. Julian A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago; Dr. Donald Wyman, Horticulturist, Arnold Arboretum of Harvard University, Jamaica Plain, Mass.; Dr. Bassett Maguire, Professor of Botany, Utah Agricultural College, Logan; Mr. C. L. Lundell, of the University of Michigan; Mr. Edgar L. Evinger, and Mr. J. M. Batchelor, Associate Soil Conservationists, Division of Research, U. S. Department of Agriculture, Washington, D. C.; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Mr. Harry Wood, Head Gardener of the Arthur Hoyt Scott Horticultural Foundation, Swarthmore College, Swarthmore, Pa.; Dr. I. A. Gamble, of Washington, D. C.,

member of the Rosarium Committee; Dr. Hiram Showalter, Professor of Biology, Kings College, Bristol, Tenn.; Dr. and Mrs. Harry D. MacGinitie, of the department of biology and geology, Humboldt State College, Arcata, Calif.; Mr. Edward C. Berry, Instructor in Biology, Central Missouri State Teachers College, Warrensburg, Mo.; Mr. F. G. Walsingham, Horticulturist at the Atkins Institution of the Arnold Arboretum of Harvard University, Cienfuegos, Cuba; Dr. Ruth Patrick, Assistant Curator, Academy of Natural Sciences, Philadelphia, Pa.; Dr. A. C. Noë, Associate Professor of Botany, University of Chicago, Chicago, Ill.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1937

GARDEN ATTENDANCE:

Total number of visitors in June	32,910
Total number of visitors in July	35,561
Total number of visitors in August	42,741

PLANT ACCESSIONS:

Total number of plants and packets of seeds donated in June	40
Total number of plants and packets of seeds donated in July	189
Total number of bulbs and cuttings donated in July	764
Total number of plants and packets of seeds donated in August	185

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	45
Total number of books and pamphlets donated in June	185
Total number of books and pamphlets bought in July	16
Total number of books and pamphlets donated in July	314
Total number of books and pamphlets bought in August	21
Total number of books and pamphlets donated in August	34

HERBARIUM ACCESSIONS:

JUNE

By Purchase—

Killip, E. P.—Plants of South America, collected by G. Klug	225
Steyermark, J. A.—Plants of Missouri	2,000

By Gift—

Anderson, E.—Plants of horticulture	11
Anderson, E.—Plants of Missouri, Arkansas, and Oklahoma	25
Barkley, F. A.—Plants of Missouri, New York, etc.	13
Beal, J. M.—Plant from horticulture	1
Bracelin, Mrs. H. P.—Acanthaceae of Peru, collected by Mexia, Mrs. Ynes	2

Crookshanks, D. R.—Plants of Missouri	16
Cutak, J.—*Pinus palustris* Mill. from Louisiana	1
Doss, T.—Plants of Arizona	4
Emig, W. H.—Plants of Pennsylvania	23
Johns, Mrs. J. J.—*Magnolia virginiana* L. from horticulture	1
Lodewyks, Maude C.—Plants of Missouri and Illinois	43
Lundell, C. L.—Plants of British Honduras and Mexico	6
Pavlick, W. E.—Plants of Missouri and Utah	32
Utah State Agricultural College by B. Maguire—Plants of Utah	156
Wild, C. M.—*Acer platanoides* L. from horticulture	1
Wild, C. M.—*Tilia cordata* Mill. from horticulture	1
By Exchange—	
Botanical Museum, University of Helsingfors -Plants of Finland	150
Field Museum of Natural History—Plants of Maine	7
Field Museum of Natural History—*Couma guatemalensis* Standl. from British Honduras	1
Purer, Edith A.—Plants of California and Lower California	77
Shreve, F.—Plants of Lower California	178
State College of Washington, collected by W. N. Suksdorf Specimens of Carex	74
U. S. National Museum—Plants of Florida and South America	4
University of Michigan by C. L. Lundell—Plants of British Honduras and Guatemala	37
University of Missouri by H. W. Rickett—Plants of Missouri	12
University of Oklahoma by M. Hopkins—Plants of New Mexico, the Wichita National Forest, etc.	87
By Transfer	
Beilmann, A. P.—Plants of horticulture	28
Cutak, L.—Plant from horticulture	1
By Field Work	
Anderson, E.—Plants of Missouri	7
Dodge, C. W.—Plants of Costa Rica, collected by C. W. Dodge and V. F. Goeger	16
Total	3,240

JULY

By Purchase—	
Gentry, H. S.—Plants of Mexico	520
By Gift—	
Anderson, E.—*Gladiolus illyricus* Koch from horticulture	1
Barkley, F. A.—Plants of Oklahoma	51
Blackwelder, Betsy—Plants of Forest Park, St. Louis, Mo.	11
Cory, V. L.—*Tradescantia* spp. of Texas	18
Crookshanks, D. R.—*Peganum Harmala* L. from New Mexico	1
Fuller, G. D.—Plants of Illinois, Colorado, etc.	±1,000

Hubricht, Leslie—Plants of Illinois and Missouri	23
Kellogg, John H.—Plants of Missouri	6
Lodewyks, Maude C.—Plants of Missouri	16
von Schrenk, H.—*Taxodium distichum* Rich. from Texas	1
By Exchange—	
New York State College of Forestry, by H. P. Brown—Plants of the Old World	1,200
By Transfer—	
Beilmann, A. P.—Plants of horticulture	3
Fairburn, D.—*Teucrium* sp. from horticulture	1
By Field Work—	
Allen, Paul H.—Plants of Panama	±150
Anderson, E.—Plants of Michigan	50
Total	3,052

August

By Purchase	
Weigel, O.--Plants of Bolivia, collected by O. Buchtien	75
By Gift—	
Barkley, Mrs. Maie Webster—Plants of Iowa	61
Crookshanks, D. R.—*Phragmites communis* L. from Missouri	1
Cutak, L.—Plant photographs	2
Heising, Clara—Plants of Missouri, Arkansas, Kansas, and New Mexico	38
Martz, E., Jr.—Orchid from Colombia, South America	1
MacGinitie, H. D.—Paleobotanical specimens from the Florissant shales of Colorado	7
Ree, Mrs. T. A.—*Veratrum Woodsii* Robbins from Missouri	1
von Schrenk, H.—Plants of Texas	110
By Exchange—	
New York Botanical Garden by A. C. Smith—Photographs of type specimens of Myristicaceae	25
University of Montana by F. A. Barkley—Plants of Oklahoma	100
By Transfer—	
Beilmann, A. P.—Plants of horticulture	34
By Field Work	
Hubricht, Leslie Plants of Missouri, Kentucky, and the Great Smoky Mountains National Park	±213
Total	668

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Missouri Botanical Garden Bulletin

Vol. XXV OCTOBER, 1937 No. 8

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

ONE OF THE GLADE GARDENS AT THE ARBORETUM

Missouri Botanical Garden Bulletin

Vol. XXV OCTOBER, 1937 No. 8

THE DEVELOPMENT OF THE WILD-FLOWER GARDENS AT THE ARBORETUM

One of the main reasons for which the Missouri Botanical Garden acquired its 1600 acres at Gray Summit was to preserve for all time a typical example of Ozark landscape. Almost the first decision with regard to the property was the setting aside of a wild-flower reservation on the cliffs and valleys along the Meramec River. These woodlands and meadows have gradually been prepared for the time when they shall be opened to the public and the Garden has come to realize what an opportunity they present. Strictly speaking, it is more than that; it is two magnificent opportunities. These several hundred acres are rapidly becoming a series of wild gardens in which the native vegetation is displayed to its best advantage. They are also an outdoor laboratory for the study of the Ozark flora. Yet the two programs are not competitive. Just as the wild gardens provide an area in which precise botanical studies can be made, so the information from the studies is necessary if we are to keep the gardens in top-notch condition.

It might be supposed that a wild garden would be the simplest kind of garden to manage. Many people have apparently had just exactly that idea, as the American countryside bears witness. In the last two decades, thanks to the motor car, many families have established country homes or camps near the cities in which they lived. Most of these people have tried a wild garden, for nothing seemed more simple. One merely fenced in a tract of ground and let nature take care of it. Whenever an attractive plant was seen it was dug up and transported to the wild garden.

Various ornamental plants were brought out from town and set out here and there. The results were usually so disappointing that those who were honest eventually gave up trying and resigned themselves to a more or less brushy area in which there was little to see after the first burst of flower in the springtime.

Taking beautiful plants from everywhere and anywhere and expecting the resultant mess to be beautiful is really naive. An analogy in terms of human society may give point to the argument. Suppose one were to try and build an effective community of human beings. He would never think of taking a few Eskimo seal hunters, several New York business leaders, one or two Arabian sheiks, and a few thrifty French peasants for a model community to be established in, shall we say, the Matanuska Valley in Alaska. However visionary he might be, he would not expect such a mixture to carry on as effectively in the new situation as in the old. Yet man is much more adaptable to new situations than any garden flower, and plant communities are inconceivably more complex than human ones.

In managing the wild-flower reservation at Gray Summit our first concern, therefore, is to find what types of plant communities really belong in that area. Strictly speaking, one does not think in terms of a single wild garden, but of the various kinds of wild gardens which might be established. The superlative advantage of the reservation at Gray Summit is that so many different types of vegetation are found within the 300 acres. There are four radically different types:

Glade gardens
Cliff-side gardens
Meadow gardens
Woodland gardens

The glade gardens are those natural rock gardens of the Ozarks which are found in locations too dry and too barren to support a forest cover. Fringed with short twisted cedars they are at once the most picturesque and the most characteristic element in the Ozark landscape. By cliff-side gardens we have indicated another characteristic feature of the Ozarks, the gray-white cliffs with rock plants growing in their crevices, and rich carpets of

spring flowers covering the talus slopes below. Of meadows, Missouri originally had two sorts, the upland prairies and the grassy open savannahs of the river bottoms. The Garden does not possess any really natural meadows. River savannahs, due to their rich soil and convenient location, were among the first parts of the virgin wilderness to come under cultivation. If there were ever any at Gray Summit they disappeared long ago. As for prairies, the Garden's property, lying, as it does, adjacent to the Meramec River, is just outside the natural prairie area. Many of the characteristic plants which are native to these two original types of vegetation are still found in the region, however, and it should ultimately be possible by mowing, supplemented with an occasional burning, to establish river meadows and upland pastures which will at least look as though they were a natural part of the landscape. The woodland gardens are of several different types depending upon whether we are considering the elm-sycamore woods in the flood plain, the rich, sugar maple-white oak woods of the ravines, the stunted oak-hickory woods of the dry ridges, or the strange semi-open woods which lie below the glades and which are caused by the gradual closing-in of what was once an open glade.

With the exception of savannahs and prairies, all of these types of vegetation are represented within the comparatively small area which has been set aside for a wild-flower reservation. For a year and a half the Garden has been taking a scrupulous inventory of this 300 acres. Nearly 500 species of flowering plants and ferns have been identified. While the number will eventually go well over 600 and perhaps even to 700, all of the commoner and more conspicuous species have certainly been collected. Although undertaken for practical ends the survey has, incidentally, been of some scientific value. It has added 50 species to those previously known to be native to Franklin County, two previously unknown in Missouri, and has turned up about half a dozen varieties which have apparently never received scientific recognition.

In addition to the species already present our inventory must also deal with those which might well be there. Such a list is fortunately not hard to procure. Previous studies by botanists connected with the Missouri Botanical Garden have given us an

unusually accurate view of the flora of the state. Our first concern has been to consider the status of those species which would be of particular interest to our visitors-to-be. At least four different sorts of plants need to be considered.

1. Plants which give a superlative mass effect in the landscape, such as the Blue Bells *(Mertensia)* and *Phlox* of the spring woodlands or the Blackeyed Susans of the summer glades.

2. Plants which are somewhat effective and, though they may not make a picture by themselves, add interest and variety in combination with other species. Here have been put such species as Jacob's Ladder *(Polemonium reptans)*, the Whorled Milkweed *(Asclepias verticillata)*, and most species of *Aster*.

3. Plants which are beautiful but delicate. These are plants of outstanding beauty which are so small that they are not effective in the landscape, as, for instance, our native orchid, the Ladies' Tresses *(Spiranthes gracilis)*.

4. Odd or interesting plants. Here are classified species which, while not superlatively beautiful, are so unusual in form or behavior that they are a potential feature for a wild garden. Such, for instance, are our native Agave or False Aloe *(Agave virginica)* and the curious little green iris *(Nemastylis acuta)*.

These four groups, then, make up our objective. To them belong the 125 or so of those most important species which a wild garden in this area might reasonably be supposed to have on display. For the purposes of our inventory it is possible to score the present condition of the wild-flower reservation with respect to these desirable species. This has been done by grading them as:

Adequately present
Fairly well represented
Rare or scattered
Apparently absent

If a species is in the first two of these groups we may be said to have succeeded with it. If it is in the last two we are still "in the red" so far as it is concerned.

A study of Table 1 and Figure 1 will show that so far as this initial inventory is concerned the Garden is in a position to be congratulated. Of the total number of desirables seventy-one

per cent are already on the success side of the ledger. Some of the scorings, of course, are a matter of personal opinion; it may be that one or two species which have been scored as adequately present are really in need of encouragement, and that various other details will need to be revised when another inventory is made. By and large, however, the diagnosis is correct and the general status of the wild garden is excellent.

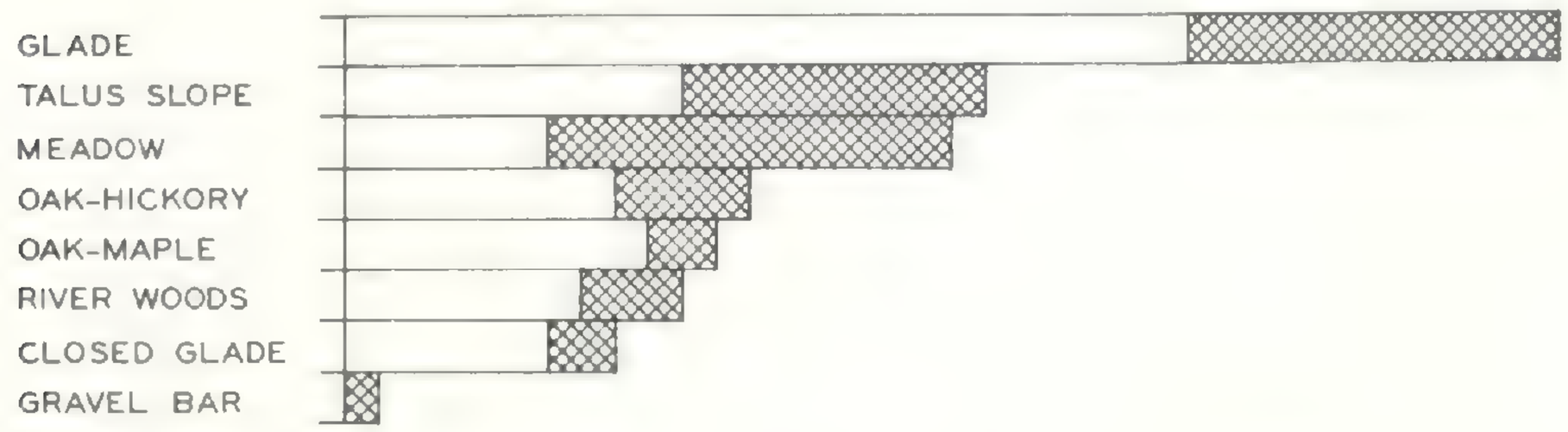

Fig. 1. The wild gardens as they are and as they might be. Solid white = species already present in good condition; cross-hatched = species which are absent or ineffective.

The unique condition of the reservation is shown when a summary is made season by season. Of the 125 possibilities, we already have in a satisfactory condition seven which bloom in early spring, twenty-three in late spring, twenty-six in the summer, and ten in the fall. This is remarkable since in the average Missouri garden, wild or otherwise, summer is the least satisfactory season. In terms of percentages, we are now operating at about 70 per cent efficiency in the early spring, 50 in the late spring, 80 in summer and 60 per cent in the autumn.

In outlining a plan for the further development of the area it is important that we make a similar analysis in terms of types of vegetation. It will be remembered that we have approximately the following kinds of gardens to consider:

Glade	Woodland
Cliff-side	Oak-hickory
Meadow	Sugar maple-white oak
Upland	Closed glade
Lowland	Flood-plain

TABLE I

Species of the Ozark Flora native to the Missouri Botanical Garden Arboretum or to its immediate vicinity. Scored for garden value, abundance in the wild gardens, natural habitat, and season of bloom.

BOTANICAL NAME	GARDEN VALUE				ABUNDANCE				NATURAL HABITAT										SEASON			
	Beautiful mass effect	Beautiful but delicate	Somewhat effective	Odd or interesting	Adequately present	Fair	Rare or scattered	Absent	Oak-hickory	White oak-sugar maple	Glade	Closed glade	Flood-plain woods	Meadows	Gravel bar	Talus slope	Brookside	Early spring	Spring	Summer	Fall
Arisaema triphyllum				X		X										X			X		
Arisaema Dracontium				X		X										X			X		
Tradescantia subaspera			X					X								X				X	
Tradescantia canaliculata			X				X				X								X		
Tradescantia virginiana			X					X				X							X		
Veratrum Woodii				X				X								X			X		
Uvularia grandiflora			X		X								X						X		
Allium stellatum	X				X						X	X									X
Nothoscordum bivalve	X				X						X							X			
Erythronium americanum			X					X								X		X			
Erythronium albidum	X					X										X		X			
Camassia hyacinthina	X					X					X							X			
Trillium recurvatum			X					X								X			X		
Agave virginica				X			X				X									X	
Iris virginica			X					X						X					X		
Iris foliosa				X				X					X						X		
Nemastylis acuta				X				X			X							X			
Cypripedium parviflorum var. *pubescens*				X				X								X			X		
Orchis spectabilis		X						X								X			X		

Spiranthes (2 species)	...	X	...	...	...	...	X	...	...	...	X	...	...	X	...	...	...	...	...	...	X
Arenaria patula	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Silene stellata	...	...	X	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	...	X	...
Claytonia virginica	X	...	...	...	X	...	...	...	...	...	...	...	X	...	...	X	...	X	...	...	...
Talinum calycinum	...	X	...	...	...	...	...	X	...	...	X	...	...	...	...	...	...	...	X	...	...
Hepatica acutiloba	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	X	...	X	...	...	...
Clematis virginiana	...	...	X	...	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	X	...
Clematis Fremontii	...	...	...	X	...	X	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Isopyrum biternatum	...	...	X	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	X	...	...
Aquilegia canadensis	...	...	X	...	...	...	X	...	...	X	...	...	...	...	...	...	...	...	X	...	...
Delphinium tricorne	...	...	X	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	X	...	...
Delphinium azureum	X	...	...	...	X	...	...	...	...	...	X	X	...	...	...	...	...	...	X	...	...
Sanguinaria canadensis	...	...	X	...	X	...	...	...	...	X	...	...	...	...	...	X	...	X	...	...	...
Stylophorum diphyllum	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...	X	...	...
Erysimum asperum	...	...	X	...	...	...	...	X	...	...	X	...	...	...	...	X	...	...	X	...	...
Iodanthus pinnatifidus	...	...	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	X	...	...
Leavenworthia uniflora	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	X	...	...	...
Aruncus sylvester	...	...	X	...	...	...	X	...	...	X	...	...	...	...	...	X	...	...	X	...	...
Rosa setigera	X	...	...	...	...	...	X	...	...	...	...	...	...	X	...	...	...	...	X	...	...
Cassia fasciculata	...	...	X	...	X	...	...	...	X	...	...	...	...	...	...	...	...	...	...	X	...
Cercis canadensis	X	...	...	...	X	...	...	...	X	X	...	...	...	...	...	X	...	X	...	...	...
Baptisia vespertina	...	...	X	...	...	...	X	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Petalostemum purpureum	...	X	...	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Astragalus distortus	...	...	X	...	...	...	X	...	...	...	...	X	...	...	...	...	...	...	X	...	...
Rhus (3 species)	X	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X
Ilex decidua	X	...	...	...	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	...	X
Hibiscus (2 species)	X	...	...	...	...	...	X	...	...	...	...	...	...	X	...	...	...	...	...	X	...
Viola pedata	X	...	...	...	...	...	X	...	X	...	X	...	...	...	...	...	...	...	X	...	...
Viola papilionacea	...	...	X	...	...	X	...	...	...	...	...	...	X	X	...	...	...	...	X	...	...
Viola striata	...	...	X	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	X	...	...
Opuntia Rafinesquii	...	...	...	X	...	...	X	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Oenothera missouriensis	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Cornus florida	X	...	...	...	...	...	X	...	...	X	...	...	...	...	...	...	...	...	X	...	...
Dodecatheon Meadia	X	...	...	...	X	...	...	...	...	...	...	X	...	...	...	...	...	...	X	...	...

TABLE I—*Continued*

BOTANICAL NAME	GARDEN VALUE				ABUNDANCE				NATURAL HABITAT									SEASON			
	Beautiful mass effect	Beautiful but delicate	Somewhat effective	Odd or interesting	Adequately present	Fair	Rare or scattered	Absent	Oak-hickory	White oak-sugar maple	Glade	Closed glade	Flood-plain woods	Meadows	Gravel bar	Talus slope	Brookside	Early spring	Spring	Summer	Fall
Sabatia angularis	X						X							X							X
Amsonia illustris			X			X									X				X		
Asclepias tuberosa	X						X				X									X	
Asclepias verticillata			X			X					X									X	
Phlox divaricata var. *Laphamii*	X				X					X									X		
Phlox paniculata			X				X						X	X						X	
Phlox pilosa var. *virens*	X						X		X										X		
Polemonium reptans			X			X				X						X			X		
Phacelia Purshii	X				X								X			X			X		
Heliotropium tenellum		X			X						X									X	
Mertensia virginica	X					X							X						X		
Lithospermum canescens			X			X					X								X		
Verbena canadensis			X				X				X							X			
Scutellaria parvula			X			X					X								X		
Physostegia virginiana		X					X							X						X	
Monarda fistulosa			X				X							X						X	
Monarda Bradburiana			X			X			X										X		
Penstemon Digitalis	X						X							X					X		
Veronicastrum virginicum			X			X				X										X	
Gerardia tenuifolia		X				X								X							X
Campsis radicans	X				X									X						X	

Ruellia caroliniensis	...	...	X	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Cephalanthus occidentalis	...	...	X	...	...	X	...	...	...	...	...	...	X	...	...	...	...	...	...	X	...
Houstonia minima	...	...	X	...	...	X	...	...	...	...	...	...	...	X	...	...	...	X	...	...	...
Houstonia angustifolia	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Campanula americana	...	...	X	...	X	...	...	...	...	...	...	X	...	...	...	...	...	...	...	X	...
Lobelia cardinalis	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...	...	...	X
Lobelia siphilitica	X	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	X	...	...	...	X
Vernonia crinita	...	...	X	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Vernonia altissima	X	...	...	...	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	X	...
Vernonia Baldwini	...	...	X	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...	X	...
Eupatorium urticaefolium	...	...	X	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	...	X	...
Liatris cylindracea	...	...	X	...	...	...	...	X	X	...	...	...	...	...	...	...	...	...	...	X	...
Liatris scariosa	X	...	...	...	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	...	X
Liatris pycnostachya	X	...	...	...	...	...	...	X	X	...	...	...	...	...	...	...	...	...	...	X	...
Solidago ulmifolia	...	...	X	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X
Solidago altissima	...	...	X	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X
Solidago serotina	...	...	X	...	...	X	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X
Solidago (several species)	...	...	X	...	...	...	X	...	X	...	...	...	...	...	...	...	...	...	...	...	X
Aster oblongifolius	...	...	X	...	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	...	X
Aster Drummondii	...	...	X	...	X	...	...	...	...	X	...	...	...	...	...	...	...	...	...	...	X
Aster (several species)	...	...	X	...	...	X	...	...	X	...	...	...	...	...	...	...	...	...	...	...	X
Aster (several species)	...	...	X	...	...	X	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X
Silphium laciniatum	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Silphium terebinthinaceum	X	...	...	...	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Silphium perfoliatum	X	...	...	...	...	...	X	...	...	...	...	...	...	X	...	...	...	...	...	X	...
Rudbeckia triloba	X	...	...	...	...	X	...	...	X	X	...	...	...	...	...	...	...	...	...	X	...
Rudbeckia hirta	...	...	X	...	...	X	...	...	...	...	...	...	...	X	...	...	...	...	X	...	...
Rudbeckia missouriensis	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Rudbeckia laciniata	...	...	X	...	X	...	...	...	...	...	...	...	X	...	...	...	...	...	...	X	...
Echinacea pallida	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	X	...	...
Echinacea paradoxa	...	...	...	X	...	...	X	...	...	...	X	...	...	...	...	...	...	...	...	X	...
Ratibida pinnata	...	...	X	...	X	...	...	...	...	...	...	...	...	X	...	...	...	...	...	X	...
Helianthus (several species)	...	...	X	...	...	...	X	...	...	...	...	...	...	X	...	...	...	...	...	...	X
Corcopsis lanceolata	X	...	...	...	X	...	...	...	...	...	X	...	...	...	...	...	...	...	...	X	...

If we again summarize in percentages of what might possibly be growing on each of these areas we find that the woodland gardens are from 70 to 90 per cent efficient, and that the glade gardens rate at least 70 per cent. The other two scores reflect the natural deficiencies of the area. Meadow gardens are only 33 per cent efficient and cliff-side gardens barely over 50. This latter score is somewhat better than might appear from the record. The species which are lacking are mainly plants which in this region prefer cool northern hillsides, yet all of the cliffs in the wild flower reservation face the south. A carefuly study of the Gray Summit property has revealed one or two small glens where brooks have cut a gorge through the slope. One of these in particular is steep-sided and well forested, and it seems more than probable that we shall be able to establish there a fair representation of such plants as Hepatica and White Trillium.

So far as the score for the meadows is concerned we are clearly in the red. It is in these areas that we are farthest from the best possible development. There is no apparent reason why the Garden should not be able to grow in quantity most of the desirable meadow-loving species which are now absent or so scattered as to be ineffective. Steps have already been taken to repair this deficiency; it was so glaring that it had become apparent as soon as the inventory was well under way. As related in the May BULLETIN a river meadow is in the process of construction. Last fall a fire-line was plowed around an abandoned field in the flood-plain and during the winter the field was burned over, thus removing the shrubs and sapling which, left to themselves, would have made it a woodland within a few more years. The results of the initial burning exceeded expectations, for the proposed meadow is already meadow-like, though horribly weedy in some portions. Many of the desirable plants are already present, however, and if we can only encourage them, they will automatically take care of the weeds. A wide strip was mowed the full length of the meadow during the second week in August, to test the effect of late mowing upon the weeds, on the one hand, and the desirable meadow plants, on the other. It seems to have been successful; if another year's observation proves that it was, we shall mow over the entire meadow next July. At the same time in a very

small way a few of the conspicuous plants which might be growing in the area are being tried out. This fall a few native Iris and a small colony of New England Aster are being moved in. If they establish themselves they will be planted in quantity in a year or two.

The problem of upland meadows is being approached in the same way. Certain parts of the wild-flower reservation had been heavily grazed before the Garden acquired the property. At the present time these areas are rapidly coming up to a kind of brushy second-growth woods. There are at least three such places within the boundaries of the reservation, and it is planned to clear out the young trees and by mowing or pasturing to develop them into little meadows. We shall be able in this way to keep the sumac bushes which were being rapidly drowned out in the shade of the young trees and to introduce a number of those species which are now on the red side of the ledger. The first of these meadows was cleared in August and already looks as though it had just grown there naturally. It seemed to offer a situation in which the Lavender Balm might be grown effectively and plants were dug along the old Pacific Road and moved to the meadow in late September. Another season will show if the attempt has been successful. It is planned to develop the two other meadows in a similar fashion next summer. Clearing the first one has convinced us that the idea is practicable and relatively inexpensive. It has also demonstrated that such meadows serve a double purpose. Not only do they provide a home for meadow plants but they also make openings from which the surrounding woodlands can be viewed when they come into leaf in the spring and brighten with color in the fall.

With the completion of the inventory, the development of the wild-flower gardens has passed through its initial phase. Once such gardens are established, there is the inconceivably more complex problem of their long-time maintenance. Precise records of the vegetation will have to be made in critical areas and observed over a series of years before we shall be in a position to speak with authority on this second phase of the problem. Such studies are already well under way, but that is another story. E. A.

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. XII

NIEREMBERGIAS

Nierembergia hippomanica.—Without the horticultural publicity with which many of the novelties are introduced to the gardener each year, *Nierembergia hippomanica* is gradually taking its place with the best of the dwarf, everblooming annuals. When we first grew this nierembergia in 1935, the neat habit of the plant and the continuous bloom from June until frost so impressed us that we again grew it in 1936. When many plants were suffering from the heat and drought of that disastrous summer this annual thrived and bloomed without interruption. Now that the 1937 season is drawing to a close and *N. hippomanica* has grown as well as in the previous two years we are convinced that this is an annual of sterling qualities which will soon become very popular. It grows equally well on light or heavy soil and has no insect pests. Each plant forms a mat a foot or more in diameter and six inches high. As the wiry stems branch they soon become top-heavy and prostrate. The branches divide and each stem bears solitary flowers as it lengthens. The flowers measure an inch in diameter and are either a light mauve or a dark Mathew's purple according to the Ridgway color charts, with a small pale lemon-yellow eye in the center. The leaves are very narrow, the largest on the main stems being three-quarters of an inch long and barely an eighth of an inch wide. The leaves on the flowering branches are needle-like, not unlike the needles of some junipers.

As seed of this nierembergia was at first scarce, no attempt was made to sow it outside. Seed was sown in March; germinated in ten days; the plants grew rapidly and were in 2½-inch pots ready for planting outdoors in early May. While the plant is sometimes described as a perennial it will have to be treated as an annual in this region. This phase of the culture was checked during the past two winters, but each spring the plants were lifeless. However, one group of nierembergias in a well-drained but exposed position, which was left unprotected during the winter of 1936-37, re-seeded so freely that the plants had to be thinned last spring. These plants bloomed all summer and are still covered with flowers at the time of this writing in early Octo-

ber. Nierembergias have many sterile flowers and only occasionally is a seed capsule formed. In the dry summer of 1936 more seed was produced than this year, when it is almost impossible to find a capsule. When only a limited amount of seed is available it is better to sow the seeds in pots or flats in early spring. Nierembergias may also be grown from cuttings.

DWARF NIEREMBERGIA

(For reasons which are detailed below the proper botanical name for this species is probably *Nierembergia caerulea*. For the present, however, we may continue to call it by the name under which it has been introduced, *N. hippomanica*.)

Few English seed catalogs listed this annual in recent years, and when they did it was always recommended as a pot plant for conservatory decoration. All illustrations in catalogs or horticultural journals show this nierembergia as a pot plant. Some catalogs suggest that it be tried outdoors in a favorable location.

For the historical facts about *Nierembergia hippomanica* we

obtain first-hand information from *Curtis's Botanical Magazine* (Vol. CLX, Tab. 9473, published February 12, 1937), where it is called *N. caerulea* Gillies ex Miers. In December, 1932, seeds of this plant, under the name of *N. hippomanica* Miers, were collected by Mr. D. O. King in the Province of Cordova in Argentina and sent to Mr. T. Hay of Hyde Park, London, England. Mr. Hay grew the plants and exhibited them June 20-21, 1933, at the meeting of the Royal Horticultural Society, where they received an award of merit under the name of *N. hippomanica.* When they were examined at Kew, in June, 1933, and compared with the typical *N. hippomanica* of Miers, the latter was found to be a dwarf plant with rose-coloured flowers. *N. caerulea* Gillies ex Miers, however, was discovered in the Province of Cordova by Dr. John Gillies, who suggested the name of *N. caerulea.* Miers described it from Gillies' specimen in 1846 in *Hooker's London Journal of Botany,* Vol. 5, p. 173. There was no further record of this plant until 1905, when R. H. M. Murdoch collected a specimen which evidently was the same species. This specimen was named *N. filicaulis,* and on the label appeared a note to the effect that horses eating this nierembergia were seized with trembling and soon died. It remains green after the grasses have dried and it is then that horses take it. It seems that both *N. hippomanica* and *N. caerulea* are poisonous to horses as they contain an alkaloid called nierembergine.

Nierembergia frutescens.—For the last few years we have grown *N. frutescens,* which is the tallest of the nierembergias seen in gardens. It reaches a height of about two feet and all summer long produces innumerable pale blue flowers which fade to almost white in the bright summer sun. It is easily raised from seed and the plant requires no special culture. At one time it was suggested as a good substitute for the perennial flax for the reason that the flowers remain open during the entire day. However, flax has a beautiful blue flower which this nierembergia cannot equal in color, and flax blooms in spring when this annual is still small. Some English gardeners state that it is hardy in sheltered places but the roots have never survived any of our winters. *N. frutescens,* a native of Chile, was given an award of merit on

NIEREMBERGIA FRUTESCENS

NIEREMBERGIA RIVULARIS (white cup-flower)

July 11, 1933, by the Royal Horticultural Society when it was exhibited by F. C. Stern, Esq. The note in the *Journal of the Royal Horticultural Society,* Vol. 59, p. 151, reads:

> "The wiry stems of this beautiful plant branch copiously, forming an elegant, small bush furnished with short, linear leaves. The relatively large, campanulate flowers appear at the tips of the branchlets, and are pale blue, lighter at the edges and blotched with purple at the centre."

We have also obtained seeds of *N. filicaulis* and *N. gracilis,* and while these supposedly are creeping plants they have been erect, and identical with *N. frutescens.* These two species are synonymous, and Bailey in *Hortus* follows the description of *N. gracilis* with: "N. frutescens is likely to be cultivated under this name."

Nierembergia rivularis.—The only other worth-while nierembergia is *N. rivularis.* Like the preceding plants it also is a native of South America, coming from the La Plata in the Argentine. It was introduced into cultivation in 1866 by Messrs. James Veitch & Sons and received a first-class certificate from the Royal Horticultural Society in that year. This is the hardiest of the nierembergias but it cannot be classed as reliably hardy. Although we have succeeded in bringing it through some winters, it is better to lift a few plants in the fall and store them in a cold-frame. In the spring they may be divided and replanted in the moist part of the rock garden. This is the more difficult of the nierembergias to grow in this region during dry summers. While the two previously mentioned species seem to thrive in dry seasons this latter variety does better in cool, damp, and partially shaded positions. It is very dwarf, growing not more than three inches in height. The flowers are pure white and the same size as the other species. However, the foliage is much different, being spatulate, and the plants produce numerous runners which root freely.

The common name for nierembergia is "cup-flower" according to *Hortus* and *Standardized Plant Names,* and *N. rivularis* is called "white cup-flower." In *Curtis's Botanical Magazine,* Vol. 22, Tab. 5608, November 1, 1866, *N. rivularis* is called the "water nierembergia," which seems very appropriate since the specific name *rivularis* indicates its moisture-loving qualities. This plant was originally collected about 1830 by a Mr. Tweedie, who stated

it abounded by the sides of the Platte river, the plant growing in such profusion that it is discerned from a great distance.

P. A. K.

NOTES

Mr. L. P. Jensen, Manager of the Garden Aboretum, has been re-elected president of the Garden Club of Gray Summit.

Mr. L. P. Jensen attended the fifth annual meeting of the Citizens Road Association, at Jefferson City, Mo., October 12.

Mr. L. P. Jensen is the author of an article: "Wild Life Conservation," in the September issue of the *Missouri Magazine* (Vol. 10, No. 3).

Mr. L. P. Jensen attended the convention of the American Institute of Park Executives at Fort Worth, Texas, September 27-30, and on September 29 led a discussion on "Parkway and Roadside Planting."

Mr. George H. Pring, Superintendent of the Garden, acted as one of the judges at the St. Louis Hills Garden Contest, September 20; at the School Gardens Flower Show, held at the Adams School, September 22; and that at the Cupples School, October 7.

The third number of Volume XXIV of the *Annals of the Missouri Botanical Garden,* containing "A Monographic Study of Rhus and Its Immediate Allies in North and Central America," and "Studies in the Anacardiaceae. II" by Dr. Fred A. Barkley, was issued in September.

In the cactus house several Stapelias, with their weird star-shaped flowers are demanding attention. Some of them are large, some are of moderate size, and some very diminutive, but all are beautifully mottled and striped with various shades of yellow, brown, red, or purple.

Mr. A. P. Beilmann, Arboriculturist to the Garden, has given the illustrated lecture "The Tree as a Living Organism," before the following organizations: Optimists Club of St. Louis, August 6; Maplewood Optimists Club, August 19; Rotary Club of St.

Louis, September 23; St. Louis Hills Garden Club, October 12; Rotary Club of Rolla, Mo., October 22.

Recent visitors to the Garden include: Dr. Robert W. Webb, Principal Cotton Technologist and Mr. M. E. Campbell, Senior Cotton Technologist, Bureau of Agricultural Economics, Washington, D. C.; Mr. L. F. Gerdes, Cotton Technologist, Bureau of Agricultural Economics, Stoneville, Miss.; Dr. A. J. Sharp, Assistant Professor of Botany, University of Tennessee, Knoxville; Mr. Reed Rollins, Junior Fellow at the Gray Herbarium of Harvard University, Cambridge, Mass.

A recent letter from Mr. Paul Allen, Manager of the Tropical Station, Balboa, Canal Zone, speaks as follows of the floral display there:

> We have certainly had a wonderful show of flowers during the entire past month. The front flight of twenty-four steps was packed with six baskets each of *Cattleya Deckeri*, carrying from six to ninety flowers per plant. They were a beautiful show, and we have had worlds of visitors. The tourists came in crowds, as well as the local people. One Sunday one of the local churches hired busses and came in a body. All the grades from the Balboa schools with their teachers came one day, and several of the colored Jamaican church societies have been over. Dr. Ditmard and his family were in, and said we had a much finer show than other gardens they had visited. We had *Angraecum Eichlerianum* in bloom for the first time on the isthmus, and a very nice plant of *B. C. Fourneirii* × *Trianae*.
>
> During the month we started three shipments off to the East Indies. We have some very nice things from them, and are promised more. We are anxious to get plants of *Grammatophyllum speciosum* which is so famous in the collection at Penang.

STATISTICAL INFORMATION FOR SEPTEMBER, 1937

GARDEN ATTENDANCE:

Total number of visitors	30,967

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	14
Total number of books and pamphlets donated	105

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	28

HERBARIUM ACCESSIONS:

By Purchase—	
Cretzoiu, Al.—Plants of Banat and Dobrogea	500
By Gift—	
Anderson, Edgar—Plants of Michigan, Indiana, Iowa, and Missouri	16
Bailey, William M.—*Cynodon Dactylon* (L.) Pers. from Illinois	1
Berry, Edward C.—Lichens of Missouri	122
Blackwelder, Miss Betsy—*Prenanthes alba* L. from Michigan	6
Greenman, J. M.—Photostats of illustration and descriptions of *Bignonia uliginosa* Gomez	4
Hubricht, Leslie—Plants of North Carolina and Missouri	3
Kellogg, John H.—Plants of Missouri	6
Moore, Mrs. George T.—*Apios tuberosa* Moench. from Michigan	1
Ownbey, Francis Marion, Jr.—Plants of Nebraska and Colorado	6
von Schrenk, Hermann—Plants of Colorado and Texas	82
By Exchange—	
Botanical Museum, Harvard University by L. O. Williams—Orchids	30
Total	777

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

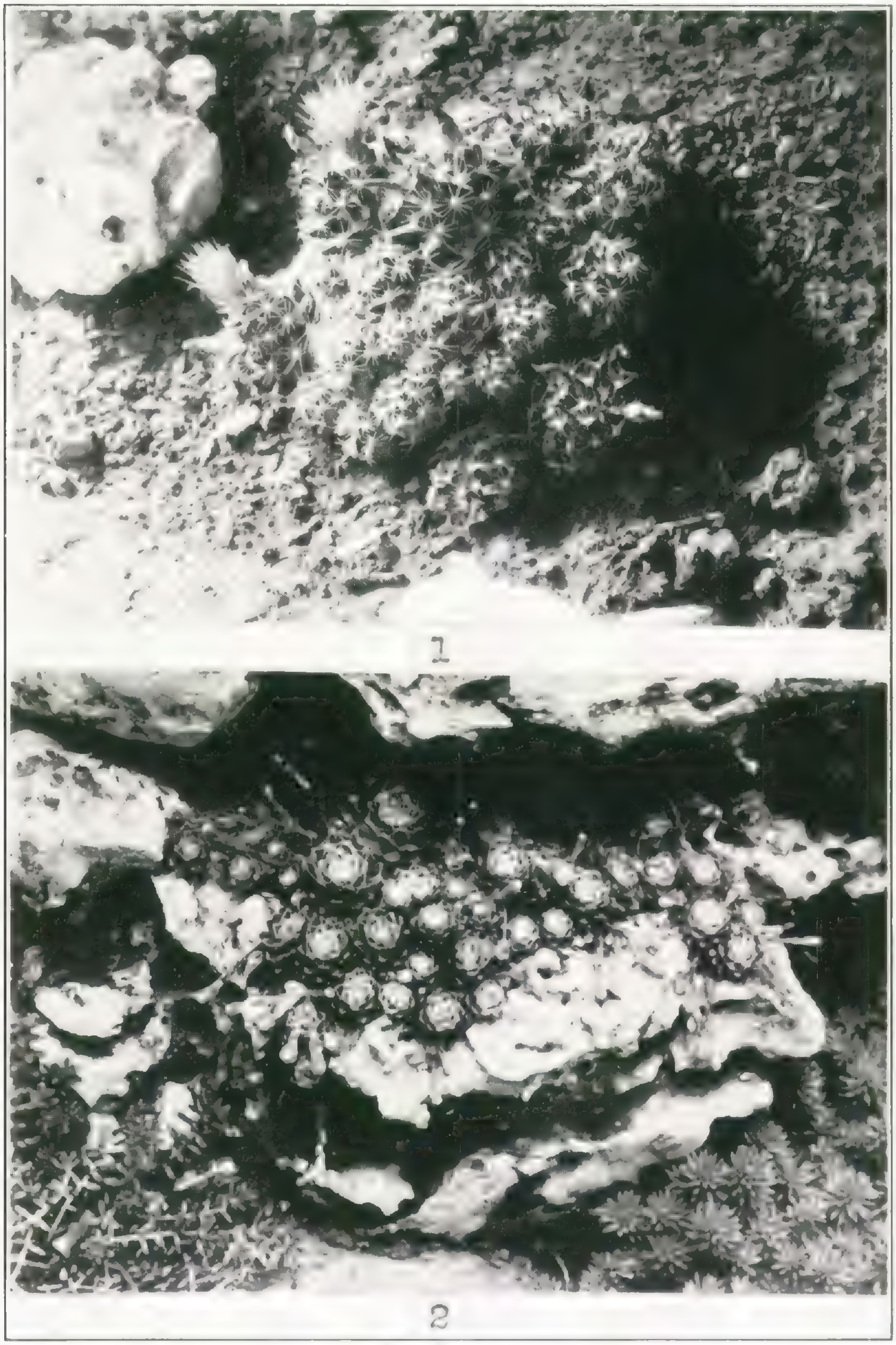

Fig. 1. NEOBESSYA SIMILIS.
Fig. 2. COBWEB HOUSELEEK (SEMPERVIVUM ARACHNOIDEUM).

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HARDY SUCCULENTS FOR THE ROCK GARDEN

Rock-garden enthusiasts in the temperate climates often overlook the odd, strangely fascinating members of the cactus family and the brilliantly colored plants that have affinity with the purslanes and orpines. Many of these gardeners are ignorant of the numerous succulents scattered over the mountains and plains of the world which are admirably suited for rock gardens. They usually associate cacti with the scorching, arid wastes of the desert, and few realize that there are several species growing widely in the mountains and cold regions of the western hemisphere. If they knew them, more of these gems would be grown in rockeries.

On the northern plains of western Canada there grows a dwarf prickly pear and a small pincushion cactus, which for many months every year are covered by blankets of snow. These are excellent plants for the rockery. Other types of prickly pear (Opuntia) and small globular cacti may be found in all the colder parts of the United States, with the possible exception of Maine, New Hampshire, and Vermont. In the Tyrolean Alps, the traveler will see many slopes bedecked in the early summer with the satiny, yellow blossoms of the American opuntias. For almost three hundred years this thorn-beset, pad-like cactus has thrived in the cool valleys at the foot of these mountains. On the wind-swept, gravelly plains of Patagonia, some very interesting cacti flourish, and one, *Opuntia australis*, grows at the Strait of Magellan, which is the southernmost extremity of cactus distribution.

Besides the spiny cacti, there are other fascinating forms that grow in the cool nooks and crannies of the world. In the Crassulaceae two genera, Sedum and Sempervivum, contain some ideal plants for the rock garden. All, or almost all, prefer the sun and a dry situation. Among the purslanes are several species of the genera Portulaca and Talinum which are very ornamental. Members of these two groups need a sunny exposure in order to unfurl their delicate flowers, and their blooming season usually continues throughout the summer months. A rockery or border should contain several noteworthy yuccas which grow lustily in the colder states. These hardy types are low-growing, with gracefully curved or rigid, sword-shaped leaves shooting up from the ground. The very variable *Yucca filamentosa* is one of the most spontaneous growers and was a garden favorite even as early as 1675. To-day, this Adam's Needle, as it is popularly called, has become an outstanding plant in roadside beautification. The succulent relative of the daffodil, *Agave virginica,* and its form, *tigrina,* grows under the same conditions and in the same soils as the hardier prickly pears.

In planting a succulent garden in cool climates no set formula can be given for all locations except that it is essential to provide good drainage especially during the dormant season. If this important matter is overlooked, then the grower invites failure. Experience has shown that a natural slope or an artificial mound affords ample drainage. The position of the slope or mound should be such that a sufficient amount of sunlight will fall upon the plants during a portion of the day. Partial shade, especially during the hottest hours of the afternoon, will benefit all succulents, even those that are exposed to the full sun in their native habitats.

The following list of hardy succulents for a rockery is by no means complete, yet it suggests a number of beautiful and curious plants that can be grown in almost all portions of temperate America. It is hoped that rock gardeners will avail themselves of this information and give a trial to these often-neglected, though worthy plants.

A common prickly-pear cactus is found wild from the east coast westward to beyond the Mississippi River. Naturally,

with such a wide distribution (almost over half of the United States), the plant presents a variable aspect in different localities and has been known by various scientific names. Britton and Rose, eminent cactus authorities, were satisfied to call this species *Opuntia Opuntia,* but since the use of repetitive names is frowned upon by many botanists, the name *Opuntia compressa* is now generally used. On the eastern coast, where it is commonly known as *O. vulgaris,* it is a low, spreading plant, with thick, orbicular to oblong joints, light green in color, very often spineless, and bearing yellowish flowers of medium size. This is the form that has become thoroughly acclimatized in Europe. The western form commonly called *O. Rafinesquii* or *O. humifusa,* is a stronger plant with joints of dark green, armed on the upper half with stout, whitish spines, and bearing larger flowers, often with a reddish center. All these names are given merely to aid in selecting this plant, since it is variously listed in catalogues. Britton and Rose give twenty-one names in their "Cactaceae" as synonyms of this particular species. In Missouri, this prickly pear can be found in many localities, and usually the owner of the land upon which they grow will be glad to let you have all you can gather. It is an excellent plant for the rockery, sending out beautiful flowers from May to July, which later mature into edible purplish fruits.

The Missouri prickly pear *(Opuntia polyacantha)* is perfectly hardy in any rockery or border. It is another low-spreading cactus with bluish- to greyish-green joints, the areoles set closely together and studded with white and dark brown spines. The flowers are yellow, the fruit spiny, dry and inedible. Some catalogues list this plant as *O. missouriensis.* In the wild state, it can be found on the arid plains of western Canada, the Dakotas, Wyoming, Montana, Nebraska, Iowa, etc.

Opuntia fragilis is a curious, small, low-spreading plant, with somewhat flattened, globular joints that break off easily, hence the name. This prickly pear, with pale yellow blossoms, is a true gem of the rockery. It is the most northern in distribution of all the opuntias, its range extending from Wisconsin westward to the Rockies and from Canada to Texas. In the wild state it is frequently hidden by the tall grass in which it grows.

The red-flowered prickly pear *(Opuntia rhodantha),* growing on the plains of Nebraska and extending into Colorado and Utah, is a superb rock-garden subject. It is a spiny plant bearing large, red to pink or salmon-colored blossoms. The prickly pear known as *O. xanthostemma* is said to be only a form of the above.

Another of the prickly pears that will lend charm to a hardy cactus bed is the yellow-flowered *Opuntia trichophora.* It is somewhat similar to *O. polyacantha,* except that the lower joints bear numerous hair-like spines. From the mountains of northern New Mexico it has migrated eastward into Oklahoma, where it is found in few isolated colonies.

Opuntia tortispina is a perfectly hardy cactus with a characteristic sulphur-colored flower. It is a prostrate, creeping "pear" and resembles the species growing in the vicinity of St. Louis. It has a wide range, and has been found hardy in New York. Sometimes it is listed as *O. cymochila.*

The brown-spined prickly pear *(Opuntia phaeacantha)* of the Rocky Mountains is a procumbent, spinous plant with large, yellow flowers. Often it forms large clumps and is very variable in form. Indians were fond of the ripened fruit. *Opuntia camanchica* is a form of this species and frequently it is listed under that name.

The cylindrical-jointed opuntias, commonly known as "wicked chollas" and "cane cactus," can also be grown in the temperate climates, but in the colder sections they will make little growth. The shrubby "tree cactus," *Opuntia imbricata,* is found on the high mesas and plains of Colorado, New Mexico, and Texas. It has been safely wintered in St. Louis, but in more northern locations it needs protection and even then rarely survives more than two or three years. This cactus must not be handled with bare hands, for the spines are very sharp. In the Navajo Indian country, *Opuntia Whipplei* is much in evidence, growing in small clumps with its silvery spines glistening in the sunlight. This species can be grown successfully in our climate if the winters are not extremely severe. *Opuntia australis* and *Darwinii,* from the cold regions of Patagonia, might thrive here, but the plants are hard to obtain. Other cane cacti which probably will prove hardy are *Opuntia viridiflora, O. leptocaulis, O. Davisii, O. clavata,* etc.

There are other prickly pears that can be safely grown in the outside rock garden in cool climates, among which may be mentioned *Opuntia macrorhiza, cantabrigiensis, stenochila, hystricina,* and *erinacea.*

A perfectly hardy and very beautiful pincushion type of cactus is *Coryphantha vivipara,* one of the few cacti that can be safely grown as far north as 52° N. Lat. It is of a variable form, usually growing in clusters and producing pinkish or purplish flowers. The plant body is almost completely hidden by the brown-tipped white to gray spines.

Another pretty pincushion cactus is *Neobesseya missouriensis,* found from Minnesota to Montana and from Manitoba in Canada to northern Texas. It grows in clusters, each tubercle crowned by a diadem of ten to twenty short, slender, gray spines. The flowers are yellow and conspicuously showy. *Neobesseya similis* grows in denser mats, but with smaller stems than *N. missouriensis.* It is hardy in Oklahoma and has withstood the St. Louis winters of 1935 and 1936. Other nipple-covered hardy cacti are *Neobesseya Notesteinii* and *Coryphantha columnaris.*

The small, globular, strongly tubercled and slender-spined *Pediocactus Simpsoni* is a worthy subject for the outdoor rockery. Some old-time gardeners still insist upon calling it *Mammillaria Purpusii.* The flowers are of a lively rose color, emerging in masses from the center of the plant.

Some of the hedgehog cacti (Echinocereus) are said to be hardy, but we have never tried these outdoors. *Echinocereus viridiflorus* is said to be about the hardiest of this group. *Echinocereus coccineus, E. octacanthus, E. Reichenbachii, E. Baileyi,* and *E. oklahomensis* may prove hardy in localities having mild winters. Other cacti native to the mountainous regions of the Southwest and of the Andes may prove hardy or near-hardy in our climate if some slight protection is given them on the very cold days.

The stonecrops or sedums are perhaps the most typical of the succulents grown in rockeries, and because many of them are so common nothing more need be said of them here. The "everliving Hen-and-chicken plants, known botanically as Sempervivums, are of very easy cultivation, needing only a well-drained soil and a sunny location for their rapid multiplication. When

the plants are placed in a rockery, they will scramble enthusiastically into all the odd nooks and crevices and soon fill them with their tiny, grey-green rosettes. The best-known of the houseleeks are *Sempervivum tectorum* and *S. arachnoideum.* The latter grows in dense masses of dainty rosettes, its leaves covered from tip to tip with a more or less cottony cobweb. It should be in every rock garden.

Among the purslanes, the most ornamental rock plants are the Talinums, with their conspicuous, ephemeral blossoms of pink and deep rose. Two species are native to Missouri, *T. calycinum* and *T. parviflorum,* the former growing within thirty miles of St. Louis. *Portulaca pilosa,* with its deep purple flowers and flowing hairs from the axils of the leaves, will lend an enchanting touch to any rockery. It is an annual and will reseed itself.

Of the liliaceous plants native to America, the yuccas are the most popular. Several species are hardy, including *Yucca filamentosa, Y. glauca, Y. Harrimaniae, Y. gloriosa,* etc. The red-flowered yucca, *Hesperaloe parviflora* from Texas, with its slender stalks of small, drooping bells, has proven hardy in St. Louis.

Numerous other plants of the succulent type can be grown in the hardy rockery, yet the list already given should be sufficient to start many on this enterprising hobby. L. C.

THE USE OF THE SUMACS BY THE AMERICAN INDIAN

Various sumacs and sumac relatives have been of extreme importance to many of the Amerinds. This is not surprising inasmuch as the sumac group has furnished very useful products in two ancient cultures. In Japan and China the lacquer trees *(Toxicodendron succedanea* and *T. vernicifera)* were the source of the finest lacquer. The Greeks and Romans made use of the currier's shrub *(Rhus Coriaria)* for medicine, tannin, and spice; and the pistachios *(Pistacia vera, P. oleosa, P. Terebinthus,* and *P. Lentiscus)* produced nuts, oil, Cyprus turpentine, and mastiche of commerce. At present the Anacardiaceae as a family contains

numerous plants furnishing lacquers, tannins, fruits, nuts, dyes, woods, and medicines of considerable economic importance.*

Rhus trilobata, the squaw-bush, lemita, or lemonade sumac, was of the greatest value to the Indians, especially the tribes of the southwestern United States. The berries, which are sour, were eaten ripe or with salt when green, and were often dried for later use. A refreshing drink was also made by soaking them with sugar in water. Palmer states that "the young twigs of the plant were used in the manufacture of baskets. The wood exhales a peculiar odor, which is always recognizable about Indian camps, and never leaves articles made from it. It grows loosely in mountain ravines, and attains a height of five to eight feet." In Utah, Arizona, southern California, and New Mexico, the Indians depended solely upon this plant for the material to make their baskets. It is tougher than the willow, which is not used by these Indians. The mode of preparation is as follows: The twigs are soaked in water to soften them and to loosen the bark. The women scrape off the bark, then split the twigs, using the mouth and both hands. The baskets are built up by binding a succession of small rolls of grass stems firmly and closely over the twigs. A bone awl is used to make the holes under the rims of grass for the split twigs. Baskets thus made are very durable, will hold water, and are often used as cooking utensils, hot stones being dropped in from time to time until the food is done. According to Wooton and Standley, the roots also were used by the Indians for their basketry and for setting dyes. The Mexicans sometimes mixed the stems of this sumac with willow branches in making their baskets. The wood of *Rhus trilobata* was much used by the Indians for bows and the leaves are said to have been an important smoking ingredient of the Comanches. The twigs are employed by members of The Zuñi's Sword Swallowers Fraternity to attach to plume offerings to their most sacred fetish, the "ettowe."

Havard states that the acidulous fruits of certain species of

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* For a discussion of the more important economic products of the Anacardiaceae, see: Sweet, H. R. & F. A. Barkley. A most useful plant family, the Anacardiaceae. Bull. Mo. Bot. Gard. **24**: 216–229. 1936; or, Barkley, F. A. A monographic study of Rhus and its immediate allies in North and Central America, including the West Indies. Ann. Mo. Bot. Gard. **24**: 265–498. 1937.

sumach, *Rhus glabra, R. typhina,* and *R. Copallina,* east of the Rocky Mountains, and *R. integrifolia* and *R. ovata,* of southern California, were bruised in water to make the drink more cooling, refreshing, and palatable. The berries were usually eaten fresh, but were often dried or even roasted for later use.

Standley reports that the flower clusters of *Rhus ovata* were boiled and eaten by the Coahuila Indians of California. A decoction of the leaves was taken as a remedy for coughs and for pains of the chest.

Both the staghorn sumac *(Rhus typhina)* and the smooth sumac *(R. glabra)* have been of particular importance in the economics of the American Indian. According to Smith, the root of the staghorn sumac was used by the Pillager Ojibwe as a remedy for hemorrhages. In speaking of its use by the Menomini Indians he says, "This tree is a very valuable one to the Indians, yielding three distinct kinds of medicines. The root bark, divested of the outer skin and inner wood, yields a tea which is a remedy for 'inward' troubles. It is of course very meagre in quantity compared to the amount of root peeled. The inner bark of the trunk is considered a valuable pile remedy and is spoken of as being 'puckering' or astringent. The 'top,' or twigs, of the smaller shrubs is hairy, and because of this is used in the treatment of various female diseases. The acid-flavored berries are used in combination with other herbs like the Greater St. John's Wort for consumption and pulmonary troubles." The Meskwaki Indians mixed the berries with the root of *Euphorbia corollata* and *Quercus macrocarpa* as a remedy for pinworms. Smith reports the use of the boiled roots by the Menomini and Ojibwe to yield a yellow dye.

The smooth sumac is an outstanding example of the wide use "primitive" man could make of a plant which at first glance would seem entirely useless. The Ojibwe made the fruit into a cooling drink in the summer, and cooked it in water with maple sugar during the winter to form a hot drink. According to Parker, the Iroquois Indians ate the newly grown sumac sprouts raw as a salad and alterative. Smith says that, "all parts of the smooth sumac are suitable for medicine—the root bark, trunk bark, twig bark, leaves, flowers and fruit. The root bark tea is used as a hemo-

static. Trunk and twig inner bark are used in combination with other medicine for their astringent qualities. Blossoms are sometimes steeped for sore eyes, leaves are used for poultices, and the fruit is considered a throat cleanser as well as being the basis of a beverage." The Pawnee Indians employed a decoction of the fruit in dysmenorrhoea and dysentery, and an infusion of the inner bark of the root for urinary troubles. Teit and Steedman report that the Indians of British Columbia use a decoction of the stems as a remedy for syphilis. Small portions of the fresh root were chewed for a sore mouth or a sore tongue. Many of the tribes collected the red leaves in the fall and dried them, to be used either alone or with tobacco as a smoking ingredient. The Omahas made a poultice of the bruised leaves, which was applied wet in cases of skin poisoning. An orange dye made by mixing the central pith of the sumac stems and bloodroot was often used to color the rush and woven mats. Seed of *Rhus glabra* has been found among the remains of the prehistoric Ozark bluff-dwellers.

According to Standley, *Rhus terebinthifolia* was used by the Zapotics of Oaxaca in steam baths as a remedy for rheumatism and syphilis, and as a preparation for parturition.

The American pistachio *(Pistacia mexicana)*, of which the branches exude a resin and the seed are edible, has had occasional use by the Indians of Mexico.

Poison ivy *(Toxicodendron radicans)* has been little used in Indian cultures. However, the Meskwaki and Potawatomi medicine men used it for poulticing some kinds of swellings.

In Mexico the gum from the pepper-tree *(Schinus molle)*, applied in the form of an emulsion, is said to hinder the development of cataracts in the eyes. It is also a remedy for genito-urinary and venereal diseases, and a syrup prepared from the fruit is used for bronchitis. The leaves are chewed to harden the gums and to heal ulcers of the mouth.

The above article was prepared at the Missouri Botanical Garden and in the Museum of Economic Botany of Harvard University. In addition to the collections of these two institutions, much information was obtained from various books and articles, the most important of which are listed on the following page:

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Standley, P. C. Trees and shrubs of Mexico. Contr. U. S. Nat. Herb. **23**: 664–671. 1923.

Stevenson, M. C. Ethnobotany of the Zuñi Indians. Ann. Rept. Bur. Am. Ethnol. **30**: 33–102. 1915.

Teit, J. A., and E. V. Steedman. Ethnobotany of the Thompson Indians of British Columbia. Ann. Rept. Bur. Am. Ethnol. **44**: 443–522. 1930.

West, G. A. Tobacco, pipes and smoking customs of the American Indian. Bull. Publ. Mus. Milwaukee **17**: 107, 115. 1934.

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Fred A. Barkley,
Herman R. Sweet.

WINTER COURSES IN GARDENING FOR AMATEURS

ELEMENTARY COURSE

The elementary course in various phases of gardening for amateurs, which has been conducted at the Garden for the past few years, will be repeated in 1938. As formerly, it will commence in January, since it is believed that the course is of more value when given earlier in the year. The class will meet in the lecture room of the museum building (entrance at Tower Grove and Cleveland Avenue gate) at 3:45 p. m., Monday of each week.

Registration: It is desirable that registration be made by letter, with check enclosed payable to the Missouri Botanical Garden, as soon after December 20 as possible. Tickets will be ready for distribution on day of first lecture. Registration fees will also be received on January 3 at the lecture hall, at 3 o'clock.

FEE: The registration fee is $5.00 for each person, and tickets are not transferable.

The outline of the subjects to be discussed follows:

January 3—Brief discussion of catalogues, horticultural magazines, and bulletins. Illustrated lecture on rock gardens and bulbs...Kohl

January 10—Trees and shrubs:
Pruning of shrubs at planting time.
Summer and winter pruning of trees and shrubs with relation to the time of bloom, i. e., trees and shrubs flowering in spring from buds formed the previous season; those blooming in summer on wood made during the current season.....Beilmann

January 17—Annuals, perennials. Illustrated lecture.....Kohl

January 24—The general care of trees:
Tree surgery.
Fertilizers.
Pruning.
Spraying.
Cabling.
Transplanting .....Beilmann

January 31—Roses. Illustrated lecture.....Kohl

February 7—Lawns:
Seed lawns: Preparation of the soil, seed selection, fertilizers.
Stolon lawns: Methods of planting by means of stolons and plugging.
Lawns and their subsequent care.....Pring

February 14—Raising plants from seed. The students will sow seeds of annuals and perennials in the greenhouses, later transferring the plants to their own gardens. Students will furnish their own seeds.....Fairburn

February 21—Iris and peonies. Illustrated lecture.....Kohl

February 28—Controlling insect pests. Material to use.....Beilmann

March 7—Water gardens. Illustrated lecture.
Construction of pools.
Preparation of soil and planting.
Caring for hardy and tropical water-lilies during growing season.
Propagation by seeds, tubers, leaves.
Breeding.
Winter storage .. ..Pring

March 14—The home culture of cacti and other succulent plants. Illustrated lecture:
Kinds for the beginner to grow.
Soil, air, light, temperature, and moisture.
Propagation by seed, cuttings, and grafting.....Cutak

March 21—The students will pot up the plants raised from seed sown Feb. 14. These plants will remain in the greenhouses until the weather permits the class members to set them out in their own gardens .....Fairburn

ADVANCED COURSE

The advanced course in gardening for amateurs will start February 3. The purpose of this course is to give the students as much practical work as possible. With the installation of new concrete benches and the enlargement of the lecture room, it is now possible to accommodate more students. All of the classes will be held in the experimental greenhouses from 10:00 to 12:00 a. m., Thursday of each week. The course will be in charge of Dr. Fairburn.

REGISTRATION: Enrollment limited to 40 students. The elementary course or previous gardening experience is a prerequisite to this advanced course.

FEE: The registration fee is $10.00 per student and tickets are not transferable. Write or phone the Garden, Pr. 5567, for reservations.

February 3—The selection and care of house plants:
Exhibit of desirable house plants. How to grow them successfully. Forcing of bulbs.

February 10—Soil management:
The characteristics of "good" soil. Study of drainage and demonstration of soil testing. Preparation of fertile garden soil.

February 17—Fertilizers:
How to improve soils by the use of fertilizers. The students will start an experiment in the greenhouse to show the effects of various fertilizer treatments on plant growth.

February 24—Insects and diseases:
Identification, control and injury caused by common garden pests. Exhibit of harmful insects, diseases, injury to plants, insecticides, fungicides, sprayers, dusters, etc. Books and bulletins on plant pests.

March 3–March 31—Plant propagation:
The propagation of plants is one of the most important and interesting phases of gardening. Five class periods will be devoted to this subject in order that the students may become familiar with a wide variety of plants and their methods of increase.

a. Seed.
b. Stem cuttings.
c. Leaf cuttings.
d. Root cuttings.
e. Hardwood cuttings.
f. Rootstocks or rhizomes.
g. Tubers.
h. Tuberous roots.
i. Bulbs, bulb scales, corms, cormels.
j. Viviparous leaves.
k. Stolons.
l. Layering.
m. Grafting, budding.

April 7—Potting of plants raised from seed.

April 14—Potting of plants raised from cuttings.

April 21—Landscaping the home grounds:
The selection, arrangement, and care of trees, shrubs, and flowers. Lawns.

April 28—Trip to the Garden Arboretum at Gray Summit where the students will have an opportunity to see the large collection of orchids, the pinetum, the nursery, and much of the native flora.

CLASS IN PRACTICAL ENTOMOLOGY

This new course is scheduled in response to a repeated demand from professional gardeners, park superintendents, tree surgeons, and the like. It will attempt to impart the fundamentals of insect control, with particular reference to woody plants and to the large-scale methods which are necessary in parks or on large estates. A certificate will be awarded to all those completing the course. The classes will be held in the Museum building, 7:30 p. m., Wednesday of each week. The lectures will be given by Mr. A. P. Beilmann, and most of them will be illustrated.

Fee: The registration fee is $5.00 per student, and tickets are not transferable. Write or phone the Garden, Pr. 5567, for reservations.

January 6, 13, 20—Anatomy and structure of insects. Three lectures.

January 27—General classification (correct terminology, practical identification).

February 2—Life histories of typical Missouri insects.

February 10—Control methods and control materials.

NOTES

Dr. George T. Moore, Director of the Garden, addressed the Women's Council of the Union Avenue Christian Church, November 11, on "Henry Shaw and His Garden."

Mr. L. P. Jensen, Manager of the Garden Arboretum, spoke before the members of the Garden Club of Gray Summit, November 1, on "Berry-bearing Trees and Shrubs for Ornamental Planting." The talk was illustrated by specimens.

Mrs. Marie Louise Evans, of the Canal Zone, gave a talk to the staff and students of the Garden and of the Shaw School of Botany, November 10, on "The Flowers and Fruits of Panama." Her talk was illustrated with her own life-size water colors, as well as slides and motion-pictures in color.

The ladies attending the convention of the American Institute of Chemical Engineers visited the chrysanthemum show at the Garden, November 18, after which Dr. Edgar Anderson, Geneticist to the Garden, gave them an illustrated talk in the Museum Building on "Henry Shaw and His Garden."

The summer of 1937 was apparently an unusually good season for the White Snakeroot, *Eupatorium urticaefolium,* which poisons the milk of cattle which graze upon it. During the past two months an unusual number of inquiries in regard to the White Snakeroot and its identification have been received at the Garden.

The members of the Rowena Clarke Garden Club of Kirkwood, Mo., visited the Garden November 15. After viewing the chrysanthemum show, they met in the auditorium at the Museum where Mr. George H. Pring, Superintendent of the Garden, gave an illustrated talk on "The Development of the Chrysanthemum Flower."

The fourth number of Volume XXIV of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued, with the following contents: "Monograph of Tetramerium and Henrya," George B. Happ; "Some Effects of Methyl Cholanthrene on the Morphology and Growth of Yeasts," Carroll W. and Bertha S. Dodge; and the "Index" to the volume.

Among those visiting the Garden recently were Dr. E. E. Naylor, Assistant Professor of Botany, Mr. J. T. Middleton, Graduate Assistant, and a party of graduate students, from the University of Missouri; Mr. Roger E. Sherman, Junior Horticulturist, and Mr. Constantine Coukas, Junior Agronomist, U. S. Dept. Agr., Soil Conservation Nursery, Elsberry, Mo.; Mr. Ira W. Clokey, of Los Angeles, Calif.; Dr. Julian A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago; Mr. E. J. Palmer, Collector and Research Assist-

ant, and Mr. Howard, both of the Arnold Arboretum of Harvard University, Jamaica Plain, Mass.; Dr. O. J. Eigsti, Head of the Department of Biology, Greenville College, Greenville, Ill.

It might be of interest to BULLETIN readers to learn that the Victoria Amazon lily growing in the center pool at the Garden has just had its centennial of discovery. The following is an excerpt from *Nature,* printed in commemoration of the event:

Discovery of the *Victoria regia.*—At a meeting of the Botanical Society held on September 7, 1837, the secretary read a communication from Robert H. Schomburgh dated New Amsterdam, Berbice, May 11, 1837, on a new genus allied to the water-lily, which by permission of Her Majesty he had named *Victoria regia.* The discovery of the plant by Schomburgh, in the River Berbice, in British Guiana, was made in January. When on the river he saw something which raised his curiosity, "All calamities were forgotten; I felt as a botanist and felt myself rewarded. A gigantic leaf, from five to six feet in diameter, salver-shaped, with a broad rim of light green above, and a vivid crimson below, resting upon the water: quite in character with the wonderful leaf was the luxuriant flower consisting of many hundred petals. The smooth water was covered with them, I rowed from one to another, and observed always something to admire. . . . We met them afterwards frequently, and the higher we advanced the more gigantic they became."

(*Nature,* September 4, 1937.)

Wolffia papulifera C. H. Thompson is one of the tiniest, as well as one of the rarest, flowering plants in North America. It is occasionally found floating as tiny dots of green on the surface of quiet pools. During the last month it has been discovered in two counties in Illinois by two botanists from the Missouri Botanical Garden. On November 6 Mr. Leslie Hubricht collected it at Burksville, Monroe County, and on November 7 Mr. Marion Ownbey collected it at Falling Spring, St. Clair County. Since plants from both localities bore flowers and since there are no previous records of this species for the state of Illinois, these collections are of considerable scientific interest.

STATISTICAL INFORMATION FOR OCTOBER, 1937

GARDEN ATTENDANCE:	
Total number of visitors	34,720
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	20
Total number of books and pamphlets donated	233
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	48
HERBARIUM ACCESSIONS:	
By Purchase—	
Degener, Otto—Plants of Hawaii	93
Grandjot, C.—Plants of Chile	500
Herter, G.—Plants of Uruguay	145
Krukoff, B. A.—Plants of Brazil	1,128
Nelson, A.—Plants of Arizona	560
Standley, P. C.—Plants of Brazil, collected by A. Ducke	550
By Gift—	
Anderson, E.—Plants of Michigan and Missouri	8
Barkley, F. A.—Plants of Montana	5
Bernice P. Bishop Museum—Lichens of Hawaii	47
Curry, D. P. by R. E. Woodson, Jr.—*Cabomba aquatica* Aubl. from Panama	1
Cutler, H. L.—Plants of Texas	97
Deam, C. C.—Plants of Indiana	2
Farlow Herbarium—Lichens of Chile	20
Greenman, J. M.—Photostats of type specimens	4
Henderson, L. F.—*Arenaria* sp. from Oregon	1
Hubricht, L.—Lichens of Missouri	44
Hubricht, L.—Plants of Indiana and Kentucky	2
Kellogg, J. H.—Plants of Missouri	2
MacGinitie, H. D.—Plants of California	5
Mallinckrodt, Edw.—*Blitum capitatum* L. from Alaska	1
Moldenke, H. N.—Photographs of type, co-type, and critical specimens of Verbenaceae	55
Whetzel, H. H.—*Septotinia* sp. from New York	1
By Exchange—	
Brenckle, J. F.—Plants of South Dakota	20
Dominion Experiment Farms, Ottawa, Canada, by Irene Mounce—*Aleurodiscus subcruentatus* (B. & C.) Burt from Quebec	1
Munz, P. A.—Photographs of type specimens of *Astragalus*, *Oenothera*, and *Gaura*	220
National Research Institute of Biology, Nanking, China—Fungi of China	785
New York Botanical Garden—Plants of Florida	474
University of California—Plants of California	36
Total	4,807

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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXV DECEMBER, 1937 No. 10

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

GLADIOLUS "QUEEN OF BREMEN"

This clump developed from a single corm after three years in the garden without a mulch of any kind.

Missouri Botanical Garden Bulletin

Vol. XXV DECEMBER, 1937 No. 10

IS THE GLADIOLUS HARDY IN MISSOURI?

In the fall of 1934 the "glads" at the Garden were dug and stored in the basement as usual. Apparently a few corms* eluded the spading fork and were left in the garden over winter. This should have finished them, as it is generally considered necessary to protect gladiolus corms from freezing. But no—it seems they were quite unconcerned about the wintry blasts, for when the smoke cleared away the following spring some vigorous new shoots pushed up through the soil, and in due time the plants produced well-developed flower spikes.

This accidental demonstration stimulated plenty of curiosity, so as a further test about one hundred varieties were planted in the spring of 1935. The corms were set six inches deep in fairly heavy soil and left in the garden throughout the winter. The planting consisted of two separate plots: one was mulched in the fall with six inches of dried leaves held in place by cornstalks (pl. 24, fig. 1), and the other plot was left entirely bare (pl. 24, fig. 2). (P. S. We put our best varieties under the mulch!)

Do you recall the winter of 1935-36? Perhaps you would rather forget it. Well, anyway, beginning about the middle of January, Missouri had one of the most protracted periods of severe cold on record. According to the weather bureau: "The last ten days of January will long be remembered for its sub-zero temperatures, with minimum readings of 25° below zero in the northern portions of the state. . . . At St. Louis January 22 to February 20 was decidedly the coldest thirty-day period on record. . . ." The ground froze solid to a depth of eighteen inches

*Gladiolus corms are frequently, but erroneously, called bulbs.

or more. Many trees, shrubs, and herbaceous perennials were severely injured or killed outright.

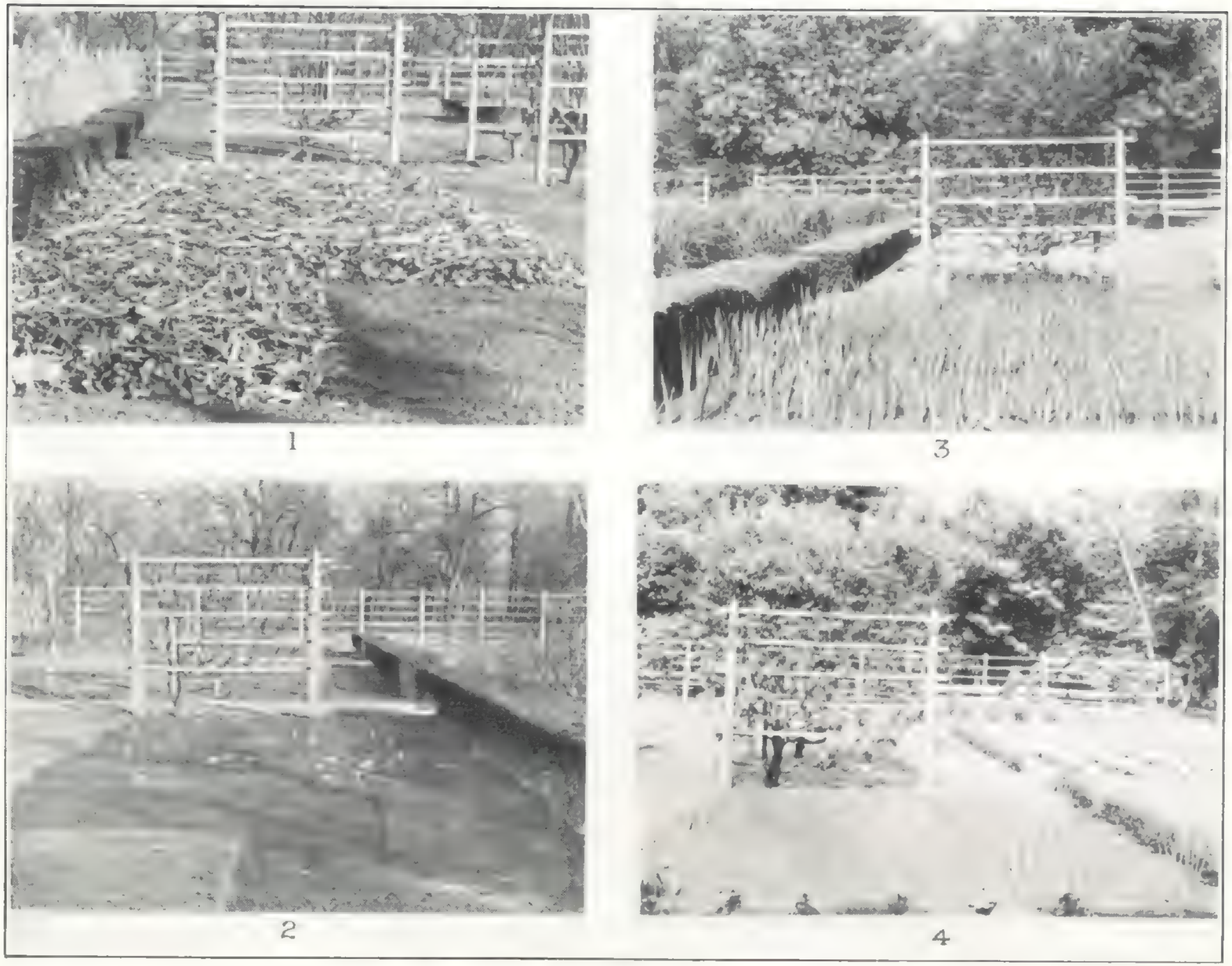
After meditating on that deep freeze and how those hapless "glad" corms were firmly embedded in ice, our hopes for their survival dropped to a flat nothing. If trees and shrubs were unable to withstand the cold, it was almost a sure bet the "glads" would be completely destroyed. When the frost was out of the ground the first part of April, we dug down in the soil to view the remains. And what do you suppose we found? Soft, rotted corms disintegrated by frost? Hardly. It was a real surprise to find those corms in a perfect state of preservation. The leaves were removed from the plot which had been mulched, and further developments were anxiously awaited.

About the middle of May, young shoots began to break through the soil. The plants in the plot which had been mulched, grew well as you will see by referring to pl. 24, fig. 3 (photograph taken early part of June). By the middle of July all the plants had produced normal flower spikes. There were a few casualties in the mulched plot, but undoubtedly these were caused by disease, not frost. In the unmulched plot injury was more apparent (pl. 24, fig. 4).

The results were so favorable that the experiment was continued another year (1936-37). The plot which had been mulched the previous winter was again covered with six inches of dried leaves, and the other plot was left bare once more. Additional corms of the varieties "Minuet," "Betty Nuthall," "Senorita," "Joerg's White," "Dr. F. E. Bennett," and "Mrs. Leon Douglas" were obtained and divided into three lots for the following treatments:

1. One-third of each variety planted outdoors in the fall of 1936. Mulched with six inches of dried leaves.
2. One-third planted outdoors, but not mulched.
3. One-third stored in a warm basement over winter and planted in the garden as usual the following spring.

The two-year-old plots responded favorably again in 1937, with the mulched plot still showing superiority over the unmulched one. But direct your attention to plate 23. Here you will see a clump of "Queen of Bremen" (photographed July 14, 1937) after growing three years in the unmulched plot. This



1 3

2 4

GLADIOLUS OVER-WINTERED IN THE GARDEN

1. Plot of gladiolus mulched in the fall with leaves and cornstalks. 2. Plot not mulched in the fall. 3. The plants grew well in the mulched plot. 4. A number of casualties occurred in the unmulched plot.

GLADIOLUS OVER WINTERED IN THE GARDEN

Results obtained from corms planted outdoors in the fall in an unmulched plot.

specimen clump developed from a single corm planted in the spring of 1935, and produced about one dozen flower spikes during the past summer. It is still in the Garden along with all the rest of the "glads" and we plan to leave them undisturbed for a number of years to see exactly what the ultimate growth responses will be.

The results of the experiment with corms of "Minuet," "Betty Nuthall," "Joerg's White," "Dr. F. E. Bennett," "Senorita," and "Mrs. Leon Douglas" may be summarized as follows:

1. The unmulched corms grew just as well as the mulched ones. There was absolutely no frost injury. Most of the plants were about four feet tall with twelve to eighteen florets on each flower spike (pl. 25).

2. Growth of the corms stored in the basement over winter and planted outdoors in spring was in no respect superior to that obtained from the corms which had been planted outdoors in the fall.

3. The only difference noticed in the three treatments was the time of flowering. Plants from the corms stored in the basement over winter flowered about one week in advance of the others. This variation may be attributed to high storage temperatures which hovered around 70°-80° F. most of the time.

Plants from the unmulched corms bloomed a day or two earlier than the mulched stock.

From these experiments it seems logical to assume that most varieties of gladiolus are hardy in Missouri, especially when the corms are planted at least six inches deep and protected by a light mulch of leaves, straw, or similar material. Aside from the standpoint of labor saved in digging, another advantage of leaving the "glads" outdoors is in the control of thrips. We are told that a storage temperature of 36° F. for two months, or 40° F. for three months, will give complete control of this insect. D. C. F.

ALOE VERA AS A REMEDY FOR BURNS

Several months ago the Missouri Botanical Garden had a request for fresh leaves of *Aloe vera,* a succulent plant from the deserts of north Africa. This curious request was granted when it was stated that the leaves were to be used in treating a severe radium burn. Since that time the Garden has continued to supply

the leaves, and the case has naturally been watched with a good deal of interest. Its technical details may well be left to the medical journals in which such accounts are published, but there are a number of facts which are of interest to the general public, particularly to those who already know *Aloe vera* as an ornamental succulent.

It is reported that the leaves came to the attention of the medical profession through their use in Florida as a home remedy for severe sunburn. If that be true it is merely one more example of the fact that the particular virtues of medicinal plants are usually discovered by common people, most often by unlettered savages. All the caffeine-bearing plants, for instance, coffee, tea, chocolate, maté, etc., were discovered and used by primitive man. While science has given us a more precise understanding of caffeine, it has not located any new plant sources of the drug. In some way the possibilities of *Aloe vera* were brought to the attention of the American medical profession a few years ago, and since that time its succulent leaves have been successfully used in treating severe burning, particularly X-ray burns and radium burns.

The actual treatment consists essentially in splitting the fresh leaf and applying its gelatinous inner surface directly to the lesion. One particularly gratifying result of the treatment is that it gives almost immediate relief to the pain which accompanies such burns.

Of all the succulent desert plants, the aloes were possibly the first to be cultivated on an extensive scale. Certain species were known for their medicinal values even before Pliny's time, and one species had been introduced into the West Indies over three hundred years ago. From Barbados, an island of the Lesser Antilles group, this West Indian plant was imported to England and became known as the Barbados aloe. The *Aloe barbadensis* of Miller's "Gardeners' Dictionary" (1752) and the *Aloe vulgaris* of Lamarck's "Encyclopaedia" (1783) are the same plants which today we know as the true aloe, *Aloe vera* Linnaeus.

Aloes are plants of the Lily family. The greater majority of them had their origin in South Africa, which is a veritable paradise for other succulent plants such as mesembryanthemums, crassulas, stapelias, and euphorbias. In less abundance (that is,

THE TRUE ALOE *(Aloe vera)* GROWING IN THE SOUTH AFRICAN HOUSE AT THE GARDEN

in the number of species) aloes are found all over the African continent, in the adjoining islands, in Arabia and India. *Aloe vera* is native to the shores of northern Africa bordering on the Mediterranean Sea but has been carried into all the tropical corners of the world, where it has become naturalized and can hardly be told from the endemic flora.

All aloes are more or less succulent. Some species, such as *Aloe Bainesii,* attain tree-like proportions with stems twenty feet high, while others, such as *Aloe aristata* and *A. humilis,* are dwarf and stemless. The leaves are arranged in rosulate fashion, with spiny-toothed margins, and contain a copious supply of sticky, viscous fluid. This juice when inspissated becomes the "bitter aloes" used in medicine. Aloes are naturally found in very dry regions, and their thickened leaves with mucilaginous juices were their means of adaptating themselves to their surroundings as their only hope of salvation. Like other fleshy-leaved succulents, they transpire very little, and one rain is sufficient to last for a long time.

An ancient method of extracting the juice from aloes was to cut the leaves transversely, the juice being caught in a vessel beneath. Miller, in his "Gardeners' Dictionary," tells of a method in which whole leaves were crushed and a greater quantity of juice was obtained, but this extraction was said to be not nearly so fine as the other. The culture of aloes was encouraged in the colonial possessions of the British Empire during the latter half of the eighteenth century, when the Colonial Legislature passed laws for granting bounties and advancing loans to landholders cultivating cotton and aloes. Among the chief staple articles produced in Barbados for export in the early nineteenth century were sugar, arrow-root, aloes, and cotton. In 1845, a shipment consisting of 1,958 packages of aloes, valued at 2,862 pounds sterling, was exported from the island to Great Britain.

Aside from the medicinal value, aloes have always been very popular with garden lovers, because of their stiff, rugged appearance. They can be grown almost anywhere (with winter protection), but in tropical gardens they grow luxuriously, sending up in profusion dense racemes of red, yellow, orange, rose, salmon, or greenish nodding flowers. Perhaps no other succulent will thrive

in the average city home with so much abuse as the aloe plant. Yet with a somewhat better treatment it will respond most gratefully and reward its benefactor. Aloes love a well-drained soil, appreciate frequent waterings during the growing season, and desire a well-lighted location, such as a sun-porch or window. Older plants need not be repotted for several years and will flower freely. Since aloes range from diminutive to large, the gardener has the opportunity of choosing those plants suitable for his particular need. Another advantage is that they are relatively free of insect pests, which perhaps can be attributed to the peculiar sap of the leaves. Only on rare occasions have mealy bugs and thrips been found on our plants.

Propagation of aloes is simple and easy. Most species produce an abundance of offshoots at their base or throw out suckers by means of underground runners, after the fashion of agaves or century-plants. These can be cut off, dried for a day or two, and then placed in a sandy soil to root. Suckers which already have roots need only be detached and planted into individual pots. Water should not be applied for several days and then only sparingly for some time. Older plants can be topped, forcing innumerable new shoots to spring from the severed stems which when large enough can be utilized for cuttings. Aloes also grow very easily from seeds, these germinating within fifteen to thirty days, and some plants flower two and three years after sowing. Left to grow in a bed, many aloes will spread over a large area, necessitating "weeding out" at least once a year where space is limited.

A description of *Aloe vera* from observations made on plants growing in the Garden's greenhouses, is as follows:

Plants nearly stemless, yet very old specimens develop stems from 1 to 1½ feet high. Leaves are 20 to 30 in number, sword-shaped, fleshy, grayish-green, arranged in a rather loose rosette; the youngest erect, older ones sub-erect and spreading, basal leaves almost flat, resting close to the ground. On young plants and suckers, the leaves at first are bright green irregularly spotted with white on both sides, later becoming glaucous. On mature plants the leaves bear no trace of blotching, are about two or more feet long, three and one-half inches broad at the base, gradually narrowing to the apex into a flattened blunt tip. Their margins

are armed with horny prickles or saw-like teeth, set about one-half inch apart, which are sharp enough to lacerate the flesh when handled carelessly. Inflorescence usually 2 to 3 feet high, with a dense raceme of yellow nodding flowers about an inch long.

L. C.

NOTES

Mr. L. P. Jensen, Manager of the Garden Arboretum, has been re-elected president of the Henry Shaw Gardenway Association.

Mr. G. H. Pring, Superintendent of the Garden, has been elected president of the St. Louis Horticultural Society for 1938.

Recent visitors to the Garden include Dr. Paul Mangelsdorf, Agronomist, Texas Agricultural Experiment Station, College Station; and Dr. Everett Davis, of the University of Virginia, Charlottesville.

Mr. Ladislaus Cutak, in charge of succulents at the Garden, is the author of an illustrated article "Succulents for Winter Window Gardens and Terrariums," appearing in the December, 1937, issue of *Garden Gossip*.

Mr. A. P. Beilmann, Arboriculturist to the Garden, gave an illustrated talk on "Garden Pests" before the Greater St. Louis Association of Gardeners, December 7, and on "Trees," before the Inspirational Club, December 8.

Dr. George T. Moore, Director of the Garden, spoke before the history of science section of the Academy of Science, December 17, on "Some Fifteenth, Sixteenth, and Seventeenth Century Contributions to the History of Botany."

Dr. Hermann von Schrenk, Pathologist to the Garden, addressed the coal operators at Prenter, West Virginia, December 10, on "Mine Timber Preservation," and the society of Sigma Xi, Missouri School of Mines, Rolla, Mo., December 14, on "Timber Research."

Mr. G. H. Pring, Superintendent of the Garden, spoke on "Curiosities in the Garden" before the Laymen's League of St.

John's Episcopal Church, December 8, and on "Romance of the Plant World," before the Clifton Heights Men's Club, December 14.

Mr. L. P. Jensen, Manager of the Garden Arboretum, gave an illustrated talk before the members of the Henry Shaw Gardenway Association, at Peck's Farm, Allenton, Mo., November 30, on "Roadside Development," and before the members of the Garden Club of Gray Summit, December 6, on "History of Landscape Gardening."

Attention is called to the gardening courses for amateurs announced in the November BULLETIN. The elementary course commences January 3, and registration should be made as soon after December 20 as possible. The fee is five dollars. The advanced course, for which the elementary course or gardening experience is a prerequisite, commences February 3. The fee for this course is ten dollars. There is also scheduled a course in practical entomology for professional gardeners, park superintendents, and the like. This will start January 6, and the fee is five dollars. Write or phone the Garden for reservations or further information.

STATISTICAL INFORMATION FOR NOVEMBER, 1937

GARDEN ATTENDANCE:

Total number of visitors	59,237

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	14
Total number of books and pamphlets donated	482

PLANT ACCESSIONS:

Total number of plants and seed packets received as gifts	79

HERBARIUM ACCESSIONS:

By Purchase

Erichsen, C. F. E.—Lichens of Germany, Nos. 601-700, inclusive	100
Harper, Roland M.—Plants of Alabama	50
Skutch, Alexander F.—Plants of Costa Rica	244
Weigel, Th. Oswald—Josef Weese, "Eumycetes selectae exsiccati," Fasc. XXXI, Nos. 751-775, inclusive	25
Williams, Louis O.—Plants of the Beartooth Mts., Montana and Wyoming	266

By Gift—	
Cutler, Hugh C.—Plants of Michigan	16
Hubricht, Leslie—Plants of Illinois and Missouri	68
Kellogg, John H.—*Crotalaria retusa* L. from Missouri	3
Lundell, C. L. by R. E. Woodson, Jr.—Plants of Mexico and Central America	12
Seibert, Russell J.—Plants of Panama	21
Steyermark, Mrs. Julian A.—Private herbarium of Mrs. J. A. Steyermark, plants of Missouri, estimated at	1,000
Woodson, R. E., Jr.—Plants of Costa Rica, collected by C. W. Dodge and others	633
By Exchange—	
Botanical Museum, Harvard University—Orchids of the Philippine Islands	143
By Transfer—	
Anderson, Edgar—*Nierembergia caerulea* Gillies ex Miers, from horticulture	1
Total	2,582

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